U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-248 293

ABSTRACTS OF THE 1971-1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE.

PART II

IIT RESEARCH INSTITUTE

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

JANUARY 1976

KEEP UP TO DATE

Between the time you ordered this report—which is only one of the hundreds of thousands in the NTIS information collection available to you—and the time you are reading this message, several *new* reports relevant to your interests probably have entered the collection.

Subscribe to the **Weekly Government Abstracts** series that will bring you summaries of new reports *as soon as they are received by NTIS* from the originators of the research. The WGA's are an NTIS weekly newsletter service covering the most recent research findings in 25 areas of industrial, technological, and sociological interest—invaluable information for executives and professionals who must keep up to date.

The executive and professional information service provided by NTIS in the **Weekly Government Abstracts** newsletters will give you thorough and comprehensive coverage of government-conducted or sponsored research activities. And you'll get this important information within two weeks of the time it's released by originating agencies.

WGA newsletters are computer produced and electronically photocomposed to slash the time gap between the release of a report and its availability. You can learn about technical innovations immediately—and use them in the most meaningful and productive ways possible for your organization. Please request NTIS-PR-205/PCW for more information.

The weekly newsletter series will keep you current. But *learn what you have missed in the past* by ordering a computer **NTISearch** of all the research reports in your area of interest, dating as far back as 1964, if you wish. Please request NTIS-PR-186/PCN for more information.

WRITE: Managing Editor
5285 Port Royal Road
Springfield, VA 22161

Keep Up To Date With SRIM

SRIM (Selected Research in Microfiche) provides you with regular, automatic distribution of the complete texts of NTIS research reports *only* in the subject areas you select. SRIM covers almost all Government research reports by subject area and/or the originating Federal or local government agency. You may subscribe by any category or subcategory of our WGA **(Weekly Government Abstracts)** or **Government Reports Announcements and Index** categories, or to the reports issued by a particular agency such as the Department of Defense, Federal Energy Administration, or Environmental Protection Agency. Other options that will give you greater selectivity are available on request.

The cost of SRIM service is only 45¢ domestic (60¢ foreign) for each complete microfiched report. Your SRIM service begins as soon as your order is received and processed and you will receive biweekly shipments thereafter. If you wish, your service will be backdated to furnish you microfiche of reports issued earlier.

Because of contractual arrangements with several Special Technology Groups, not all NTIS reports are distributed in the SRIM program. You will receive a notice in your microfiche shipments identifying the exceptionally priced reports not available through SRIM.

A deposit account with NTIS is required before this service can be initiated. If you have specific questions concerning this service, please call (703) 451-1558, or write NTIS, attention SRIM Product Manager.

This information product distributed by

NTIS U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

013004

PB 248 293

EPA-600/2-76-010b
January 1976

Environmental Protection Technology Series

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY ·

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into five series. These five broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The five series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies

This report has been assigned to the ENVIRONMENTAL PROTECTION TECHNOLOGY series. This series describes research performed to develop and demonstrate instrumentation, equipment and methodology to repair or prevent environmental degradation from point and non-point sources of pollution. This work provides the new or improved technology required for the control and treatment of pollution sources to meet environmental quality standards.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-600/2-76-016b	2.	3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE ABSTRACTS OF THE 1971-1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE - Part II	5. REPORT DATE January 1976 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) E. P. Bergmann, I. B. Fieldhouse	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS IIT Research Institute 10 W. 35th Street Chicago, Illinois 60616	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. 68-01-2234
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency Washington, DC 20460	13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE EPA-ORD

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This document is a task report of effort directed toward a search of the open literature to provide some insight into the noise reduction effort outside of the Federal Government and in foreign countries. Abstracts from the search covered the period 1971 to 1974. Two primary sources were searched for abstracts: The Engineers Index and Pollution Abstracts.

Nearly 1300 abstracts from 21 countries were screened and segregated into the following categories: Aircraft Noise; Building Noise; General Interest; Machinery Noise; Noise Effects on Health; Noise Measurement Instrumentation; and Transportation Noise. The distribution of abstracts within each technical area is summarized in the report, and a compilation of the abstracts is presented as an appendix and bound separately.

It appears that a substantial level of privately sponsored noise research and development is reflected in open literature publications. Industrial or private sponsorship is indicated in areas in which a regulation demands attention to the noise problem or a product relating to noise is being "advertised". Government sponsorship is indicated in the areas in which there is a potential benefit to the public. University sponsorship appears to be a small part of the total effort and is directed to particular academic interests.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Accoustic Noise	Transportation noise	01C
Aircraft noise	Foreign abstracts	13F
Noise reduction	Noise measurement	21E
Abstracts	Building noise	05B
	1971-74	

PRICES SUBJECT TO CHANGE

18. DISTRIBUTION STATEMENT Release to Public	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 484
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE $12.50

EPA Form 2220-1 (9-73)

EPA-600/2-76-016b
January 1976

ABSTRACTS OF THE 1971-1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE

Task Report J6331

Part II

by

E. P. Bergmann
I. B. Fieldhouse

Contract 68-01-2234

Project Officer

E. Berkau
U.S. Environmental Protection Agency
Industrial Environmental Research Lab.
Cincinnati, Ohio 45268

Prepared for

Environmental Protection Agency
Office of Research and Development
Washington, D.C. 20460

CONTENTS

Page

APPENDIX A: SOURCES SEARCHED

Publications Indexed by Engineering Abstracts 1

Master List of Serial Publications Used by Pollution Abstracts 19

Master List of Special Publications Used by Pollution Abstracts 58

APPENDIX B: ABSTRACTS

Aircraft Noise 113

Building Noise 195

General Interest Papers on Noise 224

Machinery Noise 283

Noise Effects on Health 364

Noise Measurement Instrumentation 408

Transportation Noise 428

APPENDIX A

SOURCES SEARCHED

PUBLICATIONS INDEXED BY ENGINEERING ABSTRACTS

AACE, Trans Natl Meet, 16th, 1972
Acoust Hologr, v 4, Intl Symp, 4th, 1972
Adv Heat Transfer, v 9, 1973
Adv in Comput, v 11, 1971
Adv in Concrete, Symp, Proc, 1971
Adv in Control Syst, Theory and Applications, v 8, 1971
Adv in Corros Sci and Technol, v 2, 1972
Adv in Corros Sci and Technol, v 3, 1973
Adv in Creep Des, A.E.Johnson Mem v, 1971
Adv in Heat Transfer, v 8, 1972
Adv in Info Syst Sci, v 2, 1969
Adv in Nucl Sci and Technol, v 6, 1972
Adv in Welding Process, Conf Proc, 1970
Adv Semin, 1970: Nonlinear Functional Analysis and Applications, Proc
Adv Study Inst on Methods of Prospect for Uranium Miner, Proc, 1971: Uranium Prospecting Handbook
AIAA Symp on the Aer/Hydroautics of Sailing, 4th, Proc (Ancient Interface IV), 1973
AIAA/ASME/SAE, Struct, Struct Dyn, and Mater Conf, 14th, 1973, and AIAA Dyn Spec Conf, Collect of Tech Paper, 1973
AIChE, Engr Construction Contraction, Proc, 1971
AIChE, Loss Prevention, Symp 7, 1972
AIIE Conf and Conv, 23rd Annu, Tech Paper, 1972
AIEE Conf and Conv, 25th Anniv, Tech Paper, 1973
Air Clean Conf, 12th, Proc, 1972
Air Pollut Control in Transp Engines, Symp, 1971
Airports, Key to the Air Transp Syst, Conf, 1971
Amer Ceram Soc, Adv in Nucleation and Crystallization in Glasses, Symp, 73rd Annu, 1971
Amer Ceram Soc, Adv Materials: Composites and Carbon, Symp, 1971: Papers are from a symposium presented as part of the 73rd annu meet of the soc.
Amer Concr Inst, Cracking, Deflection, and Ultimate Load of Coner Slab Syst, Symp, 1971
Amer Concr Inst, Manual of Concrete Practice, Part 2, 1972: Notation, Struct Design, Struct Specifications, Struct Analysis

Amer Congr on Surv and Mapp, ACSM-ASP Fall Conv, Proc, ACSM Tech Sess, Paper, 1972
Amer Congr on Surv and Mapp, 32nd Annu Meet, Proc, 1972
Amer Engr Model Soc, Semin, Scale Models in Engr and Des, 1972
Amer Iron Steel Inst, Steel Prod Man, 1973: Wire and Rods, Carbon Steel
Amer Min Congr, Coal Show, Rep on Coal Technol, 1972
Amer Nucl Soc, New Dev in Reactor Math and Appl, Proc, Conf-710302, 1971
Amer Sci Glassblowers Soc, 17th Symp on Art of Glassblowing, Proc, 1972
Amer Soc for Inf Sci, Workshop on Computer Composition, Proc, 1970
Amer Soc of Photogramm, ACSM-ASP Fall Conv, Proc, ASP Tech Sess, Paper, 1972
Amer Soc of Photogramm, Annu Meet, 39th, Proc, Papers, 1973
Amer Soc of Photogramm, Proc of Tech Sess of the 38th Annu Meet, 1972
Ammonia and Related Facil Saf Symp, 15th Annu, Held as Part of AIChe 73rd Natl Meet, 1972
Annu Rev of Fluid Mech v 4, 1972
Annu Rev of Fluid Mech v 5, 1973
Annu Symp on Instrum for the Process Ind, 27th Proc, 1972
ANS Natl Topical Meet, Proc, 1971: Neutron Sources and Applications
APIC Intl Tech Conf, 15th Annu, Proc, 1972
Appalachian Underground Corrosion Short Course, 16th Annu, Proc, 1971
Appl of Comput to Power Syst Prot and Metering, Conf, Proc, 1970
Appl of Exp and Theor Struc Dyn, Symp, Paper, 1972
Appl of the Finite Elem Method in Geotech Engr, Proc, Symp, 1972
Appl Spatiales des Tubes de Prises de Vues, (Space Applications of Camera Tubes), Collq Intl, 1971
Arct Logist Support Technol, Symp, Proc, Paper, 1971
ASCE, Bienn Spec Conf, 1973: Airports, Challenges of the Future
ASCE, Hydraul Div Spec Conf, 20th Annu, 1972: Bridging the Gap Between Theory and Practice
ASCE Irrig and Drain Div Spec Conf, 1972
ASCE Natl Water Resour Engr Meet, Prepr, 1973
ASCE, Optimization of Irrigation and Drainage Systems, Conf 1971
ASCE, Performance of Earth and Earth-Supported Struct, Proc, Spec Conf, 1972
ASCE, Rapid Penetration of Terr Mater, Proc, 1972
ASCE-Inst of Civ Engr (London) Jt Conf, Bienn Jt Meet, Prepr, 1972: Public Works and Society
Asilomar Conf on Circuits and Syst, 6th, Conf Rec, Paper 1972
ASM, Oxidation of Metals and Alloys, Paper, Sem, 1970
ASME, Anthol of Rail Vehicle Dyn, Eff of Train Action and Rail Car Vib, 1972
ASME, Assessment of Lubricant Tech, Spring Lubricant Symp, 1972
ASME, Citrus Engr Conf, Trans, v 19, 1973
ASME, Diesel and Gas Eng Power Div, Annu, Proc, 1971
ASME, Flexible Rotor-Bearing Syst Dyn, Des Engr Div, 2 v in 1, 1972
ASME, Generation of Isochronous Stress-Strain Curves, Presented at Winter Annu Meet, 1972
ASME Guide for Gas Transm and Distrib Piping Syst, 2nd Ed, 1973
ASME Orientat and Guide for Use of Metric Units (E58), 3rd Ed, 1973

ASME, Pressure Vessels and Piping Conf, 3rd Annu, and Petr-Mech Engr Conf, 27th Annu, 1972

ASME, Pressure Vessel and Piping Div, Paper Presented at Panel Discuss, 1972 Winter Annu Meet

ASME, Pressure Vessel and Piping/1972 Computer Programs Verification: Air to Developers and Users

ASME Rail Transp Proc, Paper and Discuss from Jt IEEE/ASME Railroad Conf, 1972, and Winter Annu Meet of ASME, 1971

ASME, Recomm Guide for the Predict of the Dispersion of Airborne Effluents, 2nd Ed, 1973

ASQC, Tech Conf, 25th Annu, Trans, 1971

ASQC, Tech Conf, 26th Annu, Trans, 1972

ASQC, Tech Conf, 27th Annu, Trans, 1973

Assessment of Airborne Particles, Proc of 3rd Rochester Intl Conf on Environmental Toxicity, 1970

Assoc Nationale de la Rech Tech, Intl Congr, Proc, 1971: Les Materiaux Composites, D'Aujourd'Hui et de Demain: Materiaux Nonveaux et Industries Tradionnelles (Today's and Tommorrow's Composite Materials: New Materials and Traditional Industries)

Assoc of Amer Railroads, 1973 Proc of the 13th Annu Meet, Adv Rep, 1973

Australia Chem Engr Conf, Paper, 1972: Development and Innovation for Australian Process Industries

Australia Comput Conf, 5th Proc, 1972

Australia Organiz for Qual Control, Victoria Div, "Profit through Quality" Conv Papers, 1971

Australas Conf on Hudraulics and Fluid Mech, 4th, Proc, 1971

Australas Inst of Min and Metal, Symp, Paper 1972: Blast Furnace Inject

Autom Multiphasic Health Test, Proc of an Intl Conf on Engr in Medicine, Engr Found Res Conf, 1970

Automot Electr Equip, Conf, Paper, 1972

Basic Princ of Rotational Molding, Paper, Semin, 1971

Battelle Inst Mater Sci Colloq, 5th, 1970: Critical Phenomena in Alloys Magnets and Superconductors

Batteries for Traction and Propulsion, Symp, Proc, 1972

Battery Council Intl, 83rd Annu Conv, 1971

Bearings Conf, 1972

Behavior and Utilization of Explosives in Engr Des and Biomech Principles Applied to Clinical Medicine, Proc of 12th Annu Symp, 1972

Berichte des III, Internationalen Symposiums fuer Photointerpretation, (Transactions of the 3rd Intl Symp on Photo-Interpretation), 1970

Biennial Conf on Carbon, 10th, Summ of Paper, 1971

Biomech and Its Appl to Autom Des, A Contin Ed Course Dev by SAE Autom Body Act Passenger Prot Comm, 1973

Biomech Symp, Presented at ASME Jt Meet, 1973: Properties of Biological Fluids and Solids, Mechanics of Tissues and Organs

Biomed Instrum and Meas, 1973

Biotelemetry, Symp, Proc, 1971

Blast Furnace Technology — Sci and Practice, Proc of C.C. Furnas Mem Conf on Ironmaking Technol, 1970

Br Cast Iron Res Assoc, Engr Properties and Performance of Modern Iron Castings, Proc, Symp, 1970

Br Comput Soc, Rep of Proc, Symp, Paper 1971: On-Line Computer Methods Relevant to Chemical Engr
Br Nucl Energy Soc, Effects of Environ on Mater Prop in Nucl Syst, Proc, Intl Conf, 1971
Bull Perm Inst Assoc Navig Congr v 2 n 12, 1972
Bundeminist Forsch Tech, Forschungsber W73-01, 1973: Ein Vergleich Gemessener Transmissions-Und Emissioness-pektren mit Berchneten Spektren in der 9,6 -Bande des Ozons (Comparison of Measured Spectra with Calculated Spectra of 9.6 Ozone Micro Region)
Bundesminist Forsch Tech, Forschungsber W73-02, 1973: Die Halbjaechrliche Dichtevariation der Thermosphaere zur Zeit Ansteigender Sonnenaktivitaet (Semi-annual Desity Variations within Thermosphere Region during Increased Solor Activity)
Bundesminist Forsch Tech, Forschungsber W73-03, 1973: Ein Raketenexperiment zur Bestimmung der Neutralgas-Zusammensetzung in Hochenbereich Zwischen 85 and 125 KM Durch ein Kryo-Massenspektrometer (Natural Gas Composition in 85 to 125 km Region as Measured by a Cryogenic Mass Spectrometer on Airborne Rocket)
Bundesminist Forsch Tech, Forschungsber W73-05, 1973: Messungen an Germanium-Bolometern im Infrarot bei Temperaturen Zwischen 1.57 K und 4.2 K (Measurements with Germanium Bolometers in Infrared Region at Temperature Range Between 1.57 K and 4.2 K)
Bundesminist Forsch Tech, Forschungsber W73-06, 1973: Untersuchungen an Einem Zweistoff-Heissgas-Raketentriebwerk zur Bahn und Lageregelung Tiroc (Investigation with Dual Propellant Hot Gas Rocket Engine for Orbit and Altitude Control)
Bundesminist Forsch Tech, Forschungsber W73-07, 1973: Fluor/Ammoniak: Einsatzmoeglichkeit Fuer Eine Transferstufe und Erste Experimentelle Erfahrungen (Experimental Results with Fluorine-Ammonia Propellant as Potential Fuel for the Transfer Stage)

Calif, Legis, Jt Comm on Seismic Safety, Earthquake Risk, Interim Rep of Spec Subcomm on San Fernando Earthquake Study, Proc, 1971
Calif, Univ, (Berkeley), Coll Engr Fluid Mech Div, Rep FM-72-1, 1972: Kinetic Theory Analysis of Rarefied Gas Flow Through Finite Length Slots
Can Commun and EHV Conf (Conference Canadiene Sur Les Communications & THT), Tech Paper, 1972
Can Inst of Min and Metal, Conf of Metall, Annu, 11th, Paper 1972
Can Inst Steel Constr, Handbook of Steel Constr, 2nd Ed, 1970
Can Pulp and Paper Assoc, Tech Sect, Annu Meet, 59th, Prepr of Paper, 1973
Can Pulp and Paper Assoc, Tech Sect Proc, Concluding with 58th Annu Meet, 1971
Can Pulp and Paper Assoc, Tech Sect Proc, Concluding with 59th Annu Meet, 1972
Can Rock Mech Symp, Proc, 6th, 1970
Can Rock Mech Symp, Proc, 7th, 1971
Can Steel Ind Constr Counc, Can Struct Engr Conf, Proc, 1972
Cavitation and Polyphase Flow Forum, presented at ASME Jt Meet, 1973
Cell Plast Conf, 3rd, Intl, 1972
Civ Engr Jap, v 11, 1972

Clean Air Conf, Intl, Proc, 1972
Coal Work Pneumoconiosis, Intl Conf, 1971
Coastal Engr Conf, Intl, 13th, Proc, 1972
Coastal Zone Pollut Manage, Symp, Proc, 1972
Cold Process of Steel, Meet, Proc, 1971 and 1972
Combust Inst, Central States Sect, Spring Meet, Preprints, 1972: Fuel Composition and Its Effects on Combustion and Emission Problems
Combust Inst, West States Sect, Paper Presented at Spring Meet, 1973: Polymer Burning and Forest Fires
Comm Role in Electr Power Res, Presented at the IEEE Summer Meet, 1972
Comput and Autom, Symp, Proc, Polytech Inst of Brooklyn, Microwave Res Inst Symp Ser v 21, 1971
Comput Designer's Conf, Tech Program, Proc, 1971
Comput Program for Circle and Strip Loads on Layered Anisotropic Media, Rep, 1972
Comput Sci and Stat, Symp on the Interface, 5th Annu, Proc, 1971
Comput 72, Tech Conf, "Islands of Appl", Paper, 1972
Comput-Comm Networks and Teletraffic, Symp, Proc, Polytech Inst of Brooklyn, Microwave Res Inst Symp Ser v 22, 1972
Concr and Reinf Concr in Hot Countries, 2nd, RILEM Intl Symp, Proc, 1971
Conf on Accidental Pollut of Inland Waters, 1971
Conf on Drill and Blasting, 1st, Proc, Paper, 1972
Conf on Fatigue of Welded Struct, Proc, Paper and Discuss, 1970
Conf on Fluid Machinery, 4th, Proc, 1972
Conf on Met Struct Res and Its Appl, Paper, 1972
Conf on Noise and Vib Control for Ind, Paper, 1972
Conf on the Prot of Met in Storage and in Transit, Proc, 1970
Conf on Underground Mining Environ, Proc, 1971
Conf Rec, 5th Asilomer Conf on Circuits and Systems, 1971
Congr Intl de Fonderie, 39th, Off Exch Paper, 1972
Contrib to the Theory of Aircr Struct, 1972
Convegno Intl Sulle Acque Sotterrannee, Atti, (Intl Symp on Ground-Water, Proc), 1970
Cornell Argric Waste Manage Conf, 4th Annu, Proc, 1972
Cornell Univ, Coll of Engr, High Frequency Generation and Amplification: Devices and Appl, Proc, 3rd, 1971
Corrosion Inhibitors, 3rd European Symp, 54th Manifistation of the European Federation of Corrosion, Proc, 1970
Cranfield Inst of Technol, Cent for Transp Stud, CTS Rep 1: Urban Transport System, Final Rep
Cranfield Inst of Technol, Cent for Transp Stud, CTS Rep 2, 1972: Magnetic Suspension and Guidance of High Speed Vehicles, Final Rep
CSIRO, Div Bldg Res, Tech Paper 30, 1972: Optimization Approach to Viscous Damping of Structures
Curved Surfaces in Engr, Comput Methods for Des and Manuf, Proc, 1972

Decis Des and the Comput, Eur Symp, 5th, of the Work Party on "Routine Comput Programs and the Use of Electron Comput in Cham Engr", 1972
Dependence of the Fracture Toughness of Mild Steel on Temperature and Crack Velocity, 1971
Des Pract: Passenger Car Autom Transm, SAE Transm Workshop Meet, 2nd Ed, 1973

Digital Equip Comput Users Soc, Fall Symp, DECUS Proc, Paper and Presentation, 1972
Digital Equip Comput Users Soc, Proc, Paper and Presentations, Symp, 1971
Dimensioning and Strength Calc, Conf, 4th, Proc, 1971
Drill and Prod Inst, Sel Paper, 1973
Dyn of Nucl Syst, Symp, 1970
Dyn Response of Struct, Symp, Proc, 1971

Econ Aspects of Weld Technol, Conf, Proc, Paper, 1971
Econ Constr of Concr Dams, Engr Found Conf, Proc, 1972
Econ Eval of COED Process Plus Char Casif, U S Off ofCoal Res, Res and Dev Rep 72, 1972
Education and Res in the Nuclear Fuel Cycle, Based on a Symp, 1970
Eff of Second-Phase Part on the Mech Prop of Steel, Conf, Proc, 1971
Elastomer Inertia Eff in Complaint Surf Bear, Columbia Univ, Lubr Res Lab, Tech Rep 19, 1972
Electr Install Conf, Proc, 1971
Electr Prop of Polymers, 1972
Electromagn Hazards, Pollut and Environ Qual, Purdue Symp, Proc, 1972
Electron Beam Metall Process Semin, 1971
Electron Beam Process Semin, 2nd, Proc (EB Semin, Europe), 1972
Electron Instrum Conf, 1971
Electron, Ion and Laser Beam Technol, Rec of 11th Symp, 1971
Electron Microscopy and Strength of Crystals, Proc, 5th Intl Mater Symp, 1971
Electron Microscopy in Material Sci, "Ettore Majorana" -- Intl Cent for Sci Culture, Intl Sch of Electron Microscopy, NATO Adv Study Inst, 1970
Electron Microscopy Soc of Amer, Proc, 29th Annu Meet, 1971
Electron 1985, Conf, Proc, 1972
Elektronikcentralen, Danish Res Cent for Applied Electron, 1971
Emissions from Contin Comb Syst, Proc, Symp, 1971
Engr Found Conf, Proc, 1972: Women in Engr and Management
Engr Geology and Soils Engr Symp, Annu, Proc, 10th, 1972
Engr Jt Council, Its Organiz and Program, 1973
Engr Sci Data Unit, Item 71003, 1971: Guide to the Voscosity of Liquid Petroleum Products
Engr Sci Data Unit, Item 71004, 1971: Flange Efficiency Factors for Curved Beams Under Bending in the Plane of Curvature
Engr Sci Data Unit, Item 71005, 1971: Buckling of Flat Plates in Shear
Engr Sci Data Unit, Item 71006, 1971: Low-Speed Longitudinal Aerodynamic Characteristics of Slender Wings
Engr Sci Data Unit, Item 71007, 1971: Low-Speed Normal Force and Pitching Moment of Slender Wings in Ground Effect
Engr Sci Data Unit, Item 71009, 1971: Design Against Fatigue Des Princ
Engr Sci Data Unit, Item 71010, 1971: Design Against Fatigue Basic Des Calculations
Engr Sci Data Unit, Item 71011, 1971: Stress Due to Interference Fit Pins and Bushes in Plates, Strips of Lugs
Engr Sci Data Unit, Item 71012, 1971: Fluid Forces on Nonstreamline Bodies Background Notes and Description of the Flow Phenomena

Engr Sci Data Unit, Item 71013, 1972: Elastic Direct Stresses and Deflections for Flat Rectangular Plates under Uniformly Distributed Normal Pressure
Engr Sci Data Unit, Item 71014, 1971: Local Buckling of Compression Panels with Flanged Stringers
Engr Sci Data Unit, Item 71015, 1971: Buckling of Thin Flat Orthotropic Plates Under Uniaxial Compression
Engr Sci Data Unit, Item 71016, 1971: Fluid Forces, Pressures and Moments on Rectangular Blocks
Engr Sci Data Unit, Item 71017, 1971: Aero-Normalised Stability Derivatives: Effect of Wing on Yawing Moment Due to Yawing
Engr Sci Data Unit, Item 71018, 1971: Approximate Wave Drag of Rectanular Planform Fairings at Zero Incidence in Supersonic Flow
Engr Sci Data Unit, Item 71025, 1971: Frictional and Retarding Forces on Aircraft Tyres-1: Introduction
Engr Sci Data Unit, Item 71026, 1971: Frictional and Retarding Forces on Aircraft Tyres-2: Estimation of Braking Force
Engr Sci Data Unit, Item 71027, 1971: Endurance of High Strength Steels in Bending
Engr Sci Data Unit, Item 72005, 1972: Estimation of R.M.S. Stress in Stiffened Skin Panels Subjected to Random Acoustic Loading
Engr Sci Data Unit, Item 72008, 1972: Frictional and Retarding Forces on Aircraft Tyres-3: Planning
Engr Sci Data Unit, Item 72009, 1972: Pressure Drop in Ducts Across Round-Wire Gauzes Normal to the Flow
Engr Sci Data Unit, Item 72010, 1972: Pressure Losses Across Perforated Plates, Orifice Plates and Cylindrical Tube Orifices in Ducts
Engr Sci Data Unit, Item 72011, 1972: Flow through a Sudden Elargement of Area in a Duct
Engr Sci Data Unit, Item 72018, 1972: Atmospheric Data for Performance Calculations, Addendum: Height in Ft, Data in Sl Units
Environ Engr, Conf on Environ Engr Probl in Ind and Dev Ctry, 1973
Environ Mercury Contamination, Conf, 1970
Environ Res in the Power Ind, the Manuf Role, Presented at the IEEE Winter Meet, 1972
European Microwave Conf, Proc, 2 v incl Suppl, 1971
European Organiz for Qual Control, 14th Conf, Proc, 1970

Ferrites, Proc of Intl Conf, 1970
Fibrous Concrete: Construction Material for the 70's, Conf Proc, Paper, 1972
Flexible Roads: Materials and Construction, Lect Notes, 1971 and 1972
Flow and Fract of Rocks, Geophys Monogr 16, 1972
Fluid Dyn Meas in Ind and Med Environ, Proc, Disa Conf, 1972
Fluid Mech of Mixing, Symp, Proc, Presented at ASME Jt Meet, 1973
Forum on Geol of Ind Miner, 8th, Proc, 1972
Fr, Dir, des Routes et de Circ Routiere, Colloq, 1972: Colloque Francais sur les Controles de Qualite en Construction Routiere (French Symp. on Quality Control in Construction of Roads and Highways)
Fract, Adv Treatise, v 5; Fract Des of Struct, 1969
Fract, Adv Treatise, v 7; Fract of Nonmetals and Composites, 1972

Fract and Flaws, ASME, Symp, 13th, Annu, Proc, 1973
Fract Toughness, Proc of Natl Symp on Fract Mech, Part 2, 1971
Front of Power Technol, Conf, Proc, 1972: Energy Environ Engr

Gas Compressor Inst, 20th, Annu, Sel Paper, 1973
Gas Turbine Paper, Presented at Tokyo, Jt Inst Gas Turbine Conf and Prod Show, 1971
Geogr Data Handling, Symp Ed, 1972
Giant Computers, Intl Comput State of the Art Rep, 1971
Going Metric, Engr Prog and Future Programmes, 3rd, Conf Rep, Metrification Board Natl Conf, 1971

Heat and Mass Transfer by Combined Forced and Natural Convection, Symp, 1971
Heavy Sect Steel Technol Program, Tech Rep 17, 1971: Three-Dimensional Elastic-Plastic Analysis for Fracture Mech -- 2, Improved Modeling
Holm Semin Electr Contract Phenom, 17th, Annu, Proc, 1971
Human Factors Soc, Annu Meet, 16th, 1972
Human Impact Response, Symp, Proc, 1972
Hydronautics, Inc, Tech Rep 7101-3, 1972: Drag Reduction and Diffusion Accompanying Thin Slit Injections of a Drag Reducing Polymer on a Flat Plate at High Reynolds Numbers
Hydronautics, Inc, Tech Rep 7103-2, 1972: Study of the Nonlinear Wave Resistance of a Two-Dimensional Source Generated Body
Hydronautics, Inc, Tech Rep 7103-4, 1972: Small Froude Number Paradoxes and Wave Resistance at Low Speeds

IEE Conf, Exhib and Manage Semin on Autom of Test, 1972
IEE Conf on Electr Variable Speed Drives, 1972
IEEE Comput Soc Intl Conf, COMPCON 72, 6th Annu Dig of Paper, 1972
IEEE Comput Soc Intl Conf, COMPCON 73, 7th Annu, Dig of Paper, 1973: Computing Networkds from Minis through Maxis: Are They for Real?
IEEE Conf on Decis and Control, and Symp on Adapt Processes, 11th, Proc, 1972
IEEE Conf on Display Devices, Paper and Abstr, 1972
IEEE Conf on Front in Ed, Dig of Tech Paper, 1971
IEEE Conf on Front in Ed, Proc, 1972
IEEE Conf on Underground Distrib, Conf Rec, Suppl, 1971
IEEE Conf Rec, Intl Conf on Communications, Proc, 1972
IEEE Conf Rec, Intl Semiconductor Power Converter Conf, Paper, 1972
IEEE Conf Rec Intl Switching Symp, 1972
IEEE, Electr Engr Probl in the Rubber and Plast Ind, 24th Annu Conf, Conf Rec, Paper, 1972
IEEE Electron and Aerosp Syst Conv, Rec, 1972: Eastcon '72
IEEE Electron Components Conf, Proc, 22nd, Annu, 1972
IEEE Ind and Commer Power Syst Tech Conf, Conf Rec, Paper, 1972
IEEE Ind Appl Soc, Annu Meet, 7th, 1972
IEEE Intl Comput Soc Conf, Conf Digest, Proc, Annu, 5th, 1971
IEEE Intl Conv Dis, Synopses of Papers Presented, 1970
IEEE, Intl Symp on Circuit Theory, Proc, 1972
IEEE, Intl Symp on Fault-Tolerant Computing, Digest of Paper, 1971
IEEE, Intl Symp on Fault-Tolerant Computing, Digest of Paper, 1972

IEEE, Intl Symp on Inf Theory, Program and Abstr of Paper, 1972
IEEE, Lect, 1972: Broadcasting Technol, Past, Present and Future
IEEE Mt-West Electromagn Compat, Conf Rec, 1971
IEEE Northeast Electronics Res and Engr Meet, NEREM Record, Tech Appl Papers, v 12, 1970
IEEE Pet and Chem Ind Conf, 19th Annu, Rec of Conf Papers, 1972
IEEE Photovoltaic Spec Conf, 9th, 1972
IEEE Power Engr Soc, Underground Transm Conf, Proc, Paper, 1972
IEEE Power Engr Soc, Underground Transm Conf, Suppl, 1972
IEEE Pulp and Paper Ind Tech Conf, Annu, Conf Rec, 1973
IEEE Reg 3 Conv, 10th, Annu, Proc, Paper, Southeas 1972: Scanning the Spectrum
IEEE Reg 6 Conf (U.S. West Reg), 1972
IEEE Reg 6 Conf (U.S. West Reg), 1973: Minicomputers and Their Appl
IEEE, Symp on Electron, Ion and Laser Beam Technol, Rec of 11th, 1971
IEEE Vehicle Technol Annu Conf, 23rd, Tech Dig, 1972
IEEE Workshop on Appl Magn, Proc, 1972
IEEE-GMTT Intl Microwave Symp, Dig of Tech Papers, 1972
IERE conf Proc, Digital Process of Signals in Commun, 1972
IERE Conf Proc, Radio Receivers and Assoc Syst, 1972
IISI, Conf, 6th Annu, Rep of Proc, 1972
Ill Inst Technol, Chicago, Res Inst, Scanning Electron Microscopy, Proc I: 5th Annu SEM Symp, and II: Workshop on Biol Specimen Prep for SEM, 1972
Impact of Comput on the Pract of Struct Engr in Concr, Symp, 118 from 160 Papers presented at ACI Fall Conv, 1970
Improving Welded Product Design Conf, Proc, Annu Autumn Meet, 1971
Incremental Motion Control Syst and Devices, 1st Annu Symp, Proc, 1972
Incremental Motion Control Syst and Devices, 2nd Annu Symp, Proc, 1973
Ind Meas and Control by Radiant Tech, Intl Conf and Exhib, 1972
Ind Process Des for Pollut control, Proc AIChE Workshop, v 4, 1971
Indian Inst of Met, Silver Jubilee Symp, 1972: Recent Developments in Metallurgical Sci and Technol: Fabrication and Treatment of Metals
Indian Roads Congr, Semin on Strengthening of Existing Road Pavements, 1971
Inf Process ul, IFIP (Intl Fed for Inf Process) Congr, Proc, 1971
Inf Serv, Inst of Gas Technol, Intl Conf on Liquified Natural Gas (Congres Intl sur le Gaz Naturel Liquefie), 3rd, Papers, 1972
Inst Chem Engr (London) Symp Ser, 34, Proc, 1971: Chem Process Hazards with Special Ref to Plat Design, 4th Proc, 1971
Inst Electr Engr, Conf Publ 81: Centralised Control Syst, Intl Conf, 1971
Inst for Briquetting and Agglomeration, 12th Biennial Conf, Proc, 1971
Inst Fr du Pet (Collect Colloq et Semin 23), 1971: Methods de Development en Mer (Methods for Development of Offshore Oilfields)
Inst Mech Engr, Component Design in High Temp Reactors Using Helium as a Coolant, Nucl Energy Group Conf, 1972
Inst Mech Engr, Pract Appl of Fract Mech to Pressure-Vessel Technol, Conft 1971
Inst of Civ Engr, London, Hazards in Construction, Proc, 1971
Inst of Engr, Aust, Conf, Tech Paper, 1971: Materials for the Electrical and Electronics Industries Conf

Inst of Engr, Aust, Thermo-Fluids Conf, Papers, 1972; Thermal Discharge: Engineering and Ecology
Inst of Environ Sci, Annu Tech Meet, 18th, Proc, 1972: Environ Progress in Sci and Deucation
Inst of Environ Sci, Annu Tech Meet, 19th, Proc, 1973
Inst of Fuel, Natl Conf on Natural Gas for Ind Boiler Firing, 1972
Inst of Fuel, Total Energy Conf, Proc v 1, 1971
Inst of Mech Engr, Symp, 1972: Elastohydrodynamic Lubrication
Inst of Min and Metall, Adv in Extractive Metall and Refining, Proc, Symp, 1971
Inst of Navig, Natl Air Meet, Proc, 1972
Inst of Navig, Natl Mar Meet, Proc, 1972
Inst of Navig, Natl Space Meet, Proc, 1972: Growth and Maturity of Navig in Space
Inst of Navig, OMEGA Symp, Proc, 1st, 1971
Inst of Nucl Mater Manage, Annu Meet, 13th, Proc, 1972
Inst of Pet, Lead in the Environ, Proc, 1972
Inst of Prod Engr, Group Technol Spec Div Semin, 1971
Inst of Scrap Iron and Steel, Inc, Rep PB 213 577, 1972: Identification of Opportunities for Increased Recycling of Ferrous Solid Waste
Inst of Water Pollut Control, Discharge of Ind Effluents to Municipal Sewerage Syst, Proc of Symp, 1971
Instrum in the Aerospace Ind, Proc of 18th Intl ISA Aerospace Div Symp, 1972
Instrum in the Chem and Pet Ind, v 9, ISA Jt Spring Conf, Proc, 1973
Intl Aerosp Instrum Symp, 7th, Proc, 1972
Intl Air Saf Semin, 25th Annu, Tech Summ of the FlightSaf Found, 1972: Human Threats to Air Safety
Intl Assoc for Bridge and Struct Engr, Rep of the Work Comm, v 8, Symp, Introd Rep, 1971
Intl Assoc for Bridge and Struct Engr, Congr, 9th, Final Rep, 1972
Intl Assoc for Great Lakes Res, Conf on Great Lakes Res, 15th, Proc, 1972
Intl Assoc for Shell Struct, IASS Calgary, Symp, Proc, 1072: Shell Struct and Climate Influences
Intl Assoc for Shell Struct, Symp on Folded Plates and Prismatic Struct, 1970
Intl Atomic Energy Agency, Peaceful Nuclear Explosions II: Their Practical Appl, Panel Proc Ser, 1971
Intl Biodeterioration Symp, 2nd, Proc, 1971
Intl Boradcast Conv, 1972
Intl Clean Air Congr, 2nd, Proc, 1970
Intl Conf on Chem Vapor Deposition, 3rd, Proc, 1972
Intl Conf on Electr Contact Phenom, 6th, Proc, Held in Conjunction with Holm Semin on Electr Contact Phenom, 18th, Annu, 1972
Intl Conf on Fluid Sealing, Proc, 5th, 1971
Intl Conf on Gas Discharges, 2nd, 1972
Intl Conf on Ion Implantation in Semiconductors, 1st, Proc, Paper, 1970
Intl Conf of Magnetohydrodyn Electr Power Generation, 5th, Proc and Paper, 1971

Intl Conf on Maximising the Yield of Nonferrous Met Process, Proc, 1971
Intl Conf on Metering, Appar and Tariffs for Electr Supply, 2nd, 1972
Intl Conf on Microzonation for Safer Constr Res and Appl, Proc, 1972
Intl Conf on Numerical Methods in Fluids Dyn, Proc, 2nd, 1970
Intl Conf on Passive Restraints, 2nd, Proc, 1972
Intl Conf on Plast Powder Coatings, 3rd, 1972
Intl Conf on Prod Dev and Manuf Technol, 2nd, Proc, 1971
Intl Conf on Struct Des of Asphalt Pavements, 3rd, 1972
Intl Conf on Transp and the Environ, Part 2, Proc, 1972
Intl Congr for Heating, Ventilating and Air-Conditioning, 5th, Paper, 1971
Intl Congr in Vitreous Enamelling, 7th, 1971
Intl Congr on Acoustics, 7th, Papers, Abstr, Proc, 1971
Intl Congr on Combust Engr, 9th, 1971
Intl Congr on Combust Engr, 10th, 1963
Intl Congr on Electron Microscopy, 7th, Summ of Paper, 1970
Intl Congr on Metallic Corros, 4th, Proc, Natl Assoc Corros Engr, 1969
Intl Congr on Protection Against Accelerator and Space Radiation, Proc, 1971
Intl Congr on Reprogr, 3rd, Proc, 1971
Intl Copper Res Assoc, Inc, Final Rep, INCRA Proj 128C, 1971: Powder Methods for Production of Wrought High Strength, High Conductivity, Thermally Stable Copper Base Alloys
Intl Copper Res Assoc, Inc, Final Rep, INCRA Proj 135B, 1972: Thermomechanical Processing and Ultrahigh-Strength, Ductile Copper-Base Alloys
Intl Copper Res Assoc, Inc, Final Rep, INCRA Proj 196, Improved Solders for Copper Alloy Radiators
Intl Copper Res Assoc, Inc, Final Rep, INCRA Proj 198, 1972: Metall Investigation of the Incramute I Cast and Heat Treated Bars
Intl Copper Res Assoc, Inc, Final Rep, INCRA Proj 2921, 1972: Thermo-Mechanical Processing of Oxide Dispersion-Strengthed Copper
Intl Cryog Engr Conf, 4th, Proc, 1972
Intl Electric Vehicle Symp, 2nd, Proc, 1971
Intl Electromagnetic Compatibility Symp Rec, 1972
Intl Electron Packag and Prod Conf, Proc, 1972: Internepcon '72
Intl Fed of Autom Control, Digital Computer Appl to Process Control, Intl Conf, 3rd, Proc, 1971
Intl Fed of Autom Control, Interfaces with the Process Control Computer: Operator, Engr and Management, Proc, Symp, 1971
Intl Fed of Autom Control, Symp on Digital Simulation of Continuous Process, Prepr, 1971

NACE, Conf, Proc, Intl Corros Forum, Paper 25, 1973: Effect of Inhibitors in Antifreeze on the Corrosion of Heat-Rejection Surfaces
NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 32, 1973: Experimental Evaluation of Local Current Density at Holidays of a Cathodically Protected Coated Pipeline
NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 35, 1973: Well Casing Interference and Potential Equalization Investigation
NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 37, 1973: Appl of Linear Polarization Measurements to the Study of Corrosion in an Operating Vehicle

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 39, 1973; Progress Rep on the Repeatability and Reproductbility of Corrosion Potential and Galvanostatic Polarization Measurements (as ASTM G01.11 Interlaboratory Testing Program)

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 55, 1973: Factors Affecting the Sulfide Stress Cracking Performance of High Strengh Steel

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 56, 1973: Laboratory Testing of Corrosion Inhibitors at Elevated Temp and Pressures

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 62, 1973: Inhibition of Corrosion under Desalination Conditions -- 4. Dynamic Studies in Small Units Producing Fresh Water from Seawater

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 63, 1973: Laboratory Experience with Alum Alloys in the Desalting Environment

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 64, 1973: Factors Controlling the Corrosion Behavior of Titanium and Titanium-Nickel Alloys in Saline Solutions

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 65, 1973: Development of Ferritic Stainless Steels for Use in Desalination Plants

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 66, 1973: Electrochemical Evaluation of Aluminum Allows for Desalination.

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 71, 1973: Cathodic Protection of Port Alfred Harbor

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 72, 1973: Cathodic Protection of Internal Surfaces of Pipes Containing Sea Water

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 76, 1973: Corrosion of Gasoline Pipeline from Lightning Fault Current in the Presence of Cathodic Protection

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 82, 1973: Electrolytic Generation of Copper Oxide Surfaces

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 94, 1973: Recent and Noteworthy Experience with Graphite Anodes

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 95, 1973: Res Spells Progress for Plastic Gas Piping Syst

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 97, 1973: Effect of Microstruct and Environ on Stress Corrosion of 7075 Alumin Alloy

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 99, 1973: Corrosion Monitoring in N-Reactor

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 102, 1973: Effect of Aging and Irradiation on the Corrosion of Zr-2.5 wt% Nb

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 106, 1973: Corrosion of Gas-Scrubbing Equip in Municipal Refuse Incinerators

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 115, 1973: Corrosion Performance of New Fastener Coatings on Operational Military Aircr

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 124, 1973: Use of Soft X-Ray Spectroscopy to Study Corrosion and Oxidation Products on Metals and Alloys

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 126, 1973: Corrosion Product Deposition in Molten Fluoride Salt Syst

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 127, 1973: Oxidation of Iron as Studied by Conversion-Electron Moessbauer Spectroscopy

NACE, Conf, Proc, Intl Corros Forum, Prepr Paper 134, 1973: Corrosion in Domestic Hot Water Syst

Nat and Behav of Grain Bound, Symp, Proc, at TMS-AIME Fall Meet, 1971
Nat Gas Process Assoc, Annu Conv, 52nd Proc, 1973
Natl Assoc of Corros Engr, Conf, Proc, 1971
Natl Congr on Technol for Prod, Paper on Adhes, 1971
Natl Dairy and Food Engr Conf, 20th Annu, Proc, 1972
Natl Dairy Housing, Conf, Paper 1973
Natl Electronic Packag and Prod Conf, Proc of the Tech Program, 1971
Natl Open Hearth and Basic Oxygen Steel Conf, 55th, Proc, 1972
Natl Res Counc Can, Aeronaut Rep LR-567, 1973: Measurements of the Statistical Properties of Atmosph Turbulence at Altitudes Below 1000 ft
Natl Res Counc Can, Div Mech Engr, Mech Engr Rep MH-110, 1972: Comput Control and Data Acquisition of a Tidal Model
Natl Res Counc Can, Div Mech Engr, Mech Engr Rep MT-64, 1972: High Speed Water Jets from Vertically Accelerated Rotating Cones
Natl Sci Found (NSFSP-9), Natl Ocean Sediment Coring Program, 1972: Initial Rep of the Deep Sea Drilling Proj, v 9
Natl Sci Found (NSFSP-11), Natl Ocean Sediment Coring Program, 1972: Initial Rep of the Deep Sea Drilling Proj, v 11
Natl Sci Found (NSFSP-12), Natl Ocean Sediment Coring Program, 1972: Initial Rep of the Deep Sea Drilling Proj, v 12
Natl Sci Found (NSFSP-14), Natl Ocean Sediment Coring Program, 1972: Initial Rep of the Deep Sea Drilling Proj, v 14
Natl Symp on Rock Fragm, 1st, Paper, 1973
Natl Telecommuni-ations Conf, NTC Rec, 1972
NATO Conf on Reliab Test and Reliab Eval, Proc, 1972
NATO Conf, Proc, 1972: Appl of Operational Res to Transp Probl
NOTA (Natl Cable Telev Assoc) Conv, 20th, Annu, Off Transcript, 1971: CATV, The Second Generation
New Dev in Grinding, Proc, Intl Grinding Conf, 1972
New Mater in Concr Constr, Conf, Proc, 1972
New York State, Southeast Water Supply Comm, Local Government Conf, Proc: Series of Meet with Local Officials on a County Basis, 1971 and 1972
New York State, Southeast Water Supply Comm, State Agency Conf, Proc, Temporary State Comm on the Water Supply Needs of SE New York, State Agency Conf Held with Various Agencies, 1971
Noise and Vibration Control Engr, Proc of Noise Control Conf, 1971
Norske Ingeniorforening (Norway Soc of Prof Engr), Symp on the Fluoride Probl in the Primary Alumi Smelting Ind, Intl, Prepr, Paper, 1972
North Amer Rapid Excavation and Tunneling Conf, Proc, 1972
Noyes Data Corp (Pollut Control Rev 11), Fine Dust and Particulates Removal, 1972

Offshore Technol Conf, 4th, Annu, Prepr, Paper, 1972
Ohio Univ Acid Mine Drainage Workship, Proc, 1971
Ontario Ind Waste Conf, 19th Proc, 1972
Oper of Large BOF's Tech Sess, Proc, Held after the Autum Gen Meet of Iron and Steel Inst, Longon, England, 1971
Opt Soc Amer, Topical Meet on Integrated Opt -- Guided Waves, Mater, and Devices, Digest of Tech Papers, 1972
Org for Econ Coop and Dev, Educ and Train for Met Worker of 1980, Final Rep, Semin, 1968

Org for Econ Coop and Dev, Proc, Symp on Qual Control of Road Works, 1970
Oxidation of Metals, v 5 n 2, 1972
Ozone in Water and Wastewater Treatment, 1972

Pac Chem Engr Congr, 1st, 1972
Pac Southwest Miner Ind Conf, Paper, Prepr, 1972
Passenger Environ, Conf, 1972
Percept and Appl of Flashing Lights, Intl Symp, 1971
Performance Test Proced: Sodium Recovery Units, Prep by TAPPI Steam and Power Comm, CA Rep 39, 1972
Period Inst of Pressure Vessels, Conf, Papers, 1972
Personal Rapid Transit, Sel of Papers on Primising New Mode of Public Transp, Conf, 1st, 1971
Pet Technol Symp, Prepr, Papers, 1972
Phase eransformations, Papers presented at the 22nd ASM Semin, 1968
Phosphates in Food Processing, Symp, 1970
Photogr Sci and Engr in Med: Equip and Tech, Proc, Tutorial, Semin, Paper, 1972
Phys und Technol des Plasmastrahls in der Schweiss-tech (Physics and Technol of Plasma Jet Welding Methods), Colloq, 2nd, Paper, 1971
Plansee Seminar, 7th, 1971
Plast Inst (London) Dev in Films for Packaging, Conf, 1972
Plast Inst (London), Filament Winding II, RPG Conf, 1972
Plast Inst (London), Res Proj III, RPG Conf, 1971
Plast Inst/Agrement Board Conf, 1971: Plastics in Fire: Building
Pneum Transp of Solids in Pipes, Intl Conf, 1st, Proc, Paper, 1971: Pneumotransport I
Porcelain Enamel Inst, Tech Forum, Proc, v 33, 1971
Porcelain Enamel Inst, Tech Forum, Proc, v 34, 1972
Power, Pollution and Public Policy, Issues in Electric Power Production, Shoreline Recreation, and Air and Water Pollution Facing New England and the Nation, Mass Inst Technol Rep 24, 1971
Power Sources Symp, 25th, Proc, 1972
Predict of Cool/Freezing Times for Food Prod, Paper Presented at Symp at ASHRAI Semiannu Meet, 1972
Pressure Vessels and Piping: Design and Anal "A Decade of Prog", v 2: Components and Struct Dyn, 1972
Probab Des of Reinf Concr Build, Symp, 5 Papers presented at ACI Annu Conv, 1971
Product Liability Prevention Conf, Proc, 1971
Prog Astronaut Aeronaut, Fundam of Spacecr Therm Des v 29: Technical Papers Selected from the AIAA 9th Aerosp Sci Meet, Conf, 1971
Progr in Powder Metall, v 28, Proc of the Natl Powder Matall Conf, 1972
Progr Polym Sci, Japan, v 1, 1971
Progr Polym Sci, Japan, v 2, 1971
Progr Polym Sci, Japan, v 3, 1972
Progr Polym Sci, Japan, v 4, 1972
Progr Polym Sci, Japan, v 5, 1973
Programming and Machine Organiz, Symp, Proc, 1971
Protective Coatings on Metals, v 4, Special Res Rep, 1972
Purdue Univ, School of Ind Engr, Carbide Cutting Tool Sci and Engr Semin, 2nd, 1971

Queen's Univ, Therm Fluid Sci Group, Rep 1/73, 1973; Experimental Study of Mean Combined Convective Heat Transfer Rates from Oblong Cylinders to Air

Queen's Univ, Therm Fluid Sci Group, Rep 2/73, 1973: Effects of Confining Walls Upon Natural Convection from a Heated Horizontal Cylinder

Queen's Univ, Therm Fluid Sci Group, Rep 3/73, 1973: Effects of Internal Conduction of the Determination of Heat Transfer Rates Using Thin Film Heated Models

Radio Tech Comm for Mar Serv Assem Meet, Symp Paper 63-72/DO-64, 1972, v 1: Marine Traffic Systems

Radio Tech Comm for Mar Serv Assem Meet, Symp Paper 64-72/DO-65, 1972, v 2: Safe Ship Operations

Radio Tech Comm for Mar Serv Assem Meet, Symp Paper 65-72/DO-66, 1972, v 3: Maritime Satellite Systems

Radio Tech Comm for Mar Serv Assem Meet, Symp Paper 66-72/DO-67, 1972, v 4: Trends in Marine Communications

Railway Cybernetics, 3rd Intl Symp, Proc, 1970

Raman Spectroscopy, Theory and Practice, v 2

Rapid Methods for Measuring Radioactivity in the Environ, Proc of Intl Symp, 1971

Recryst of Met Mater, Paper presented at Semin of Inst fuer Metallkd of Univ of Stuttgart and Max-Planck Inst fuer Metallforsch, 1970

Refrig Syst for Perishable Food Delivery Vehicle, Symp, Paper presented at ASHRAE Annu Meet, 1971

Relay Conf, 20th, Proc, Paper, 1972

Reliab and Maintainability Symp, Annu, Proc, 1972

Reliab and Maintainability Symp, Annu, Proc, 1973

Reliab Physics, Symp, 10th, Annu, Proc, 1972

Remote Syst Technol, Conf, 20th, Proc, 1972

Residual Gases in Electron Tubes, Proc, 4th Intl, 1971

Rheol of Lubr, Conf, Proc, 1972

RILEM, Intl Symp on Refract Concr, Proc, 1971

RILEM, Symp, Intl, 1971: L'Analyse Experimental des Problemes D'Instabilite sur Modeles Reduits ou en Vraie Grandeur (Experimental Analysis of Instability Problems on Reduced and Full-Scale Models)

River Ecology and Man, Proc, Symp, 1971

Rocky Mt Bioengr Symp, 10th Annu, Proc, 1973

Rubbercon 72, Intl Rubber Conf, Proc, 1972

S African Tunnelling Conf, Technol and Potential of Tunnelling, 1970

SAE Spec Publ SP-377, 1973: Williamsburg Conf on Highway Safety Res, 1972

Saf and Reliab of Met Struct, Spec Conf, 1972

Saf Conf, 4th, Papers, 1972

Saf in High Pressure Polyethylene Plants, Chem Engr Prog, Tech Man, 1973

Sagamore Army Materials Res Conf, 18th, Proc, 1971: Powder Metall for High-Performance Applications

Salinity and Water Use, Natl Symp on Hydrology, 2nd, 1971

SAMPLE Natl Symp and Exhib, 18th, 1973: New Horizons in Mater and Proc

SAMPLE Tech Conf and Exhib, 4th, Natl, 1972: Nonmetall Mater: Selection, Processing and Environ Behavior

San Diego Biomedical Symp, Proc, v 10, 1971
Scand Corros Cong (NKM 6), 6th, Proc, Papers, 1971
Schweissnaht als Konstruktionselem im Chem Apparatebau, (Welding Seams in Struct Design of Chem Ind Installations), Symp, Paper, 1971
SDCE (Soc of Die Cast Engr) Intl Die Cast Congr, 7th, Trans, 1972
Semicond and Semimetals, v 9: Modulation Techniques, 1972
Semicond/IC Process and Prod Conf, Proc of the Tech Program, 1972
SMPTE, Cable Telev, Proc of the Symp, 1970
SNAME Spring Meet Paper, 1972: Ship Optinomics
Soc of Amer Value Engr, Proc, v 7, Natl Conf, 1972
Soc of Environ Engrs, Envirn Engr Aspects of Pollut Control, Symp, 1971
Soc of Min Engr of AIME, Geotechnical Practice for Stability in Open Pit Mining, Proc of the 2nd Intl Conf on Stability in Open Pit Mining, 1971
Soc Pet Engr, AIME, Conf on Drill and Rock Mech, 6th, Prepr, 1973
Soc Pet Engr AIME, Prepr, for Meet, Oct 8-11 1972
Soc Pet Engr AIME, Prepr, for Meet, Apr 2-3 1973
Soc Pet Engr AIME, Symp, Prepr, Paper, 1972: Handling of Oilfield Waters
Soil Sci Soc Amer, Proc, v 37 n 2, 1973
Solid Waste Treatment and Disposal, Intl Ed, Proc, 1971
Solvent Extr in Metall Processes, Intl Symp, Proc, 1972
South Water Resour and Pollut Control Conf, 20th, Annu, Proc, 1971
Southamption, England, Univ, Inform Syst for Des, Proc, Symp, 1971
Southeast conf on Theor and Appl Mech, 6th, Proc, 1972
Southwest Res Inst, ORNL, Heavy Sect Steel Technol Program, Tech Rep 18, 1972: Tests of 6 in. Thick Flawed Tensile Specimens, First and Second Technical Summary Reps
Space Congr, 9th, Proc, 1972
SPE, Annu Tech Conf, 31st, Papers, 1973
SPE, Reg Tech Conf, Tech Papers, Challenge of Thermosets, 1973
SPE, Reg Tech Conf, Tech Paper, Flexible Vinyls and Human Safety: An Objective Analysis, 1973
SPE, Reg Tech Conf, Tech Paper for Meet Philadelphia Sect 1972: Coloring of Plastics, VI
SPE, Reg Tech Conf, Tech Paper for Meet Tennessee Valley Sect: Continu Processing of Molten Plastics, 1972
SPE, Reg Tech Conf, Tech Paper: Plastecology 1972
SPW, Reg Tech Conf, Tech Paper: Thermoset VI Retec, 1972
SPE, Reinforced Plastics-IX, Meet Postprint, 1971
Speech Commun and Process, 1972 Conf Rec
SPIE Semin Proc v 22, 1971: Photo-Optical Instrumentation; Present and Future Developments
SPIE Semin Proc, v 28, Semin-in-Depth, 1972: Instrumentation in Astronomy
SPIE Semin Proc v 29: Imaging TEchniques for Testing and Inspection, Semin in-Depth, Proc, 1972
SPIE Semin Proc, v 30, Semin-in-Depth, 1971: Photographic Instrumentation: A Tool for Solving Highway and Traffic Engr Problems
SPWLA (Soc of Prof Well Log Anal) Logging Symp, 14th, Annu, Trans, Paper, 1973
Stainless Steel, Symp, 8th, Annu, Proc, 1971
Stapp Car Crash Conf, 16th, Proc, 1972
Statens Inst Byggnadsforsk, Natl Swedish Bldg Res, Doc D12, 1972: Sematic Model for Describing Perceived Environ

Steel Ind and the Environ, Proc of the 2nd C.C. Furnas Mem Conf, 1971
STI/PUB/301, Nuclear Power Plant Control and Instrumentation, Proc of a Working Group Meet, 1971
Steet Salting: Urban Water Quality Workship, Proc, 1971
Stress Analysis and Growth of Cracks, Proc of Natil Symp on Fracture Mech, Part I, 1971
Symp on Abnormal Subsurface Pore Pressure, 3rd, Soc of Pen Engr, Prepr, 1972
Symp on Air Pollut, Turbulence and Diffusion, Proc, 1971
Symp on Comput, Proc, 1972
Symp on Electrodeposited Met as Mater for Sci Appl, 1971
Symp on Engr Aspects of Magnetohydrodynamics, Proc, 12th, 1972
Symp on Equip for High Pressure Process in Pet Refineries, 1972
Symp on Fundam of Transp Phenom in Porous Media, 2nd, Proc, 1972
Symp on Nonlinear Estimation Theory and Its Appl, 2nd, Proc, 1971
Symp on Nuclear Ships, Proc, 1971
Symp on Polym Sci and Engr, 1972
Symp on Rock Mech, 13th, Proc, 1971: Stability of Rock Slopes
Symp on Rock Mech, 14th, Proc, 1972: New Horizons in Roch Mech
Symp on Small Craft, Proc, Paper, 1971
Symp on Spec Ceram, 5th, Proc, 1970
Symp on Temp, 5th, Proc, Paper, 1971: Temperature: Its Measurememt and Control in Science and Industry, v 4
Symp on the Future of Conurbation Transp, 6th, 1972
Symp on the Future of Ultrason Spectrosc, Rev of State-of-the-Art, Paper, 1970
Symp on Thermophys Prop, 6th, Proc, 1973
Synthetic Fuels from Coal Conf, 2nd, 1972
Synthetic Lubricants, Chem Process Rev 59, 1972
Syst Build Conf, Proc, 1972
Syst Identification of Vib Struc, ASME, Winter Annu Meet, Paper, 1972

Tall Timbers Fire Ecol Conf, 12th, Annu, Proc, 1972
TAPPI, Alkaline Pulping Conf, 26th, 1972
TAPPI Coating Conf, 23rd, Annu, 1972
TAPPI Coating Conf, 24th, Annu, 1973
TAPPI Corrugated Containers Conf, 1972
TAPPI Corrugated Containers Conf, 1973
TAPPI Engr Conf, 1972
TAPPI Environ Conf, 1972
TAPPI, Finishing Conf, 1972
TAPPI, Graphic Arts Conf, 1972
TAPPI, Intl Sulfide Pulping and Recovery Conf, 1972
TAPPI, Papermakers Conf, 1st, Annu, 1972
TAPPI, Reprography Conf, 2nd, 1972
Techniques Involving Extreme Environ, Nondestructive Techniques, Comput Methods in Metals Res, and Data Analy -- 1, Tech Met Res, v 7, Part 1, 1972
Technol for Metall Ind, Rev Course, Residential Conf, Ser 2, n 6, v 1, Prepr, v 2, Proc 1972

Terotechnol in Iron and Steelworks Conf, Proc, 1972
Texas Univ, Cent Res Water Resour, Tech Paper CRWR-95, 1972: Wastewater Effluent for Power Plant Cooling
Test Solvent Technol: Update '73, Symp, 1973
Theory of Imperfect Crystalline Solids, Lect Presented at Intl Course at Trieste, 1970
Theory of Machines and Computations, Proc of Intl Symp, 1971
Tools for Coastal Manage, Proc, 1972
Top in Ocean Engr, v 2, 1970
Toronto Univ, Inst Aerosp Stud, UTIAS Rev 37, 1973: Effect of Resistance to Skidding on Accidents: Surface Dressing on Elevated Sect of M4 Mtrwy
Transport Theory, 2nd Conf, 1971
Tribology Conv, 1972
TRW Syst Broup (ORNL, Heavy Sect Steel Technol Program, Tech Rep 19), 1972: Effects of Strain Gradients on the Gross Strain Crack Tolerance of A533-B Steel

Univ Hawaii, Look Lab Oceanogr Engr, Tech Rep 26, 1972: Swaying, Rolling and Yawing Response Operators of Moored Vessels
Univ Hawaii, Look Lab Oceanogr Engr, Tech Rep 27, 1972: Diagrams for the Significant Double Amplitides of the Swaying, Rolling and Yawing Motions of Moored Ships in Irregular Seals
Univ Hawaii, Look Lab Oceanogr Engr, Tech Rep 28, 1972: Comparison of the Saying, Rolling and Yawing Response Operators Obtained from Computer Programs Asymo with Experimental and Theoretical Results
Univ Hawaii, Water Resour Res Cent, Tech Rep 61, 1972: Rainfall Climatology of Hilo, Hawaii
US Air Force Mater Lab, Air Force Syst Command, Wright-Patterson AFB, Ohio, Tech Rep AFML TR-71-237, 1971: Final Rep on Joining Techniques for Fabrication of High-Temperature Superalloy Blades
US Army Electron Command, Symp on Frequency Control, Annu, Proc, 25th, 1971
US Army Tank Autom Command, TACOM, Mobility Syst Lab, Tech Rep 11758, Final Rep RE-448, 1973: Appl of Plasticity Theory to the Solution of the Rigid Wheel-Soil Interaction Probl
US At Energy Comm Off Inf Serv, Forum, 1970-1971: Environ and Ecol Forum
US At Energy Comm, Radiation Induced Voids in Metals, Symp, Proc, 1971
US Environ Prot Agency, Air Pollut Tech Data, APTD 1364, Per, 1972: Evaluating Transp Controls to Reduce Motor Vehicle Emissions in Major Metropolitan Areas
US Off of Coal Res, Res and Dev Rep 68, Final Rep, 1971: Feasibility Stud of a Coal Slurry Feeding Syst for High Pressure Gasifiers
US Off Coal Res, Res and Dev Rep 69, 1972: Prod of Flyash-Based Struct Mater

Ver Dtsch Eisenhuettenleute Together with Haus der Technik, Essen, Ger, Lect, 1972: Herstellung Von Halbzung und Warmgewalzten Flacherzeugnissen (Manufacture of Semifinished Products and Flat Hot-Rolled Products)
Vibration and Noise in Motor Vehicles, Symp, Inst Mech Engr, 1971
Video Cartridge, Cassette and Disc Player Syst, Symp, Proc, 1971

Vysk Ustav Vodn Hospod, Bratislava, Pr Stud, 58, 1971: Automatika Regulacia Prietokov A Hladin V Hydraulickom Modelovom Vyskume (Automatic Discharge and Water Level Regulation Within the Hydraulic Model)

Vysk Ustav Vodn Hospod, Bratislava, Pr Stud, 64, 1972: Vplyv Geologickeho Podlozia Pri Urcovani Prognozy Kvality Vody V Nadrziach (Interaction of the Geological Substrate and Reservoir Water Quality Forecasting)

Washington (State) State Univ, Pullman, Symp on Particleboard, Proc, 5th, 1971

Water and Pollut Control Sch, 45th, Annu, Proc, 1971

Water for Texas, Annu Conf, 16th, Proc, 1971: Urban Water Resources Planning and Management

Water Qual Conf, 14th, Proc, 1972: Groundwater Quality and Treatment

Water's Edge: Crit Probl of the Coastal Zone, Coastal Zone Workshop, 1972

Weldability of Struct and Pressure Vessel Steels, Conf Proc, 1970

West Can Water and Sweage Conf, 23rd Annu Conv, Paper, 1971

West Can Water and Sewage Conf, 24th Annu Conv, Paper, 1972

West Electron Show and Conv, 1972: Wescon Technical Papers, v 16

West Snow Conf, 40th, Annu Meet, Proc, 1972

Westinghouse Electr Corp, Nucl Energy Syst (ORNL, Heavy Sect Steel Technol Program, Tech Rep 16) 1971: Effect of an Environ of High Temp Primary Grade Nucl Reactor Water on the Fatigue Crach Growth Character of A533 Grade B Class 1 Plate and Weldment Material

Wind Loads on Struct, Proc of USA-Japan Res Semin, 1970

Women in Engr, Conf, Proc, 1971

Workshop on Microprogramm, 5th, Annu, Prepr, Paper, 1972

World Cong on Theory of Mach and Mech, 3rd, Proc, 1971

Wyo Univ, Water Resour Res Inst, Water Resour Ser 27, 1972: Water Resour Observatory Climatological Data, Water Year 1971

Wyo Univ, Water Resour Res Inst, Water Resour Ser 32, 1973: Water Resour Observatory Streamflow Data, Water Year 1972

Wyo Univ, Water Resour Res Inst, Water Resour Ser 33, 1973: Streamflow Data Usage in Wyoming

Wyo Univ, Water Resour Res Inst, Water Resour Ser 34, 1973: Water Resour Observatory Climatological Data, Water Year 1972

Wyo Univ, Water Resour Res Inst, Water Resour Ser 35, 1973: Look Back at the First Seven Years of Wyo, WRRI (196501971)

Wyo Univ, Water Resour Res Inst, Water Resour Ser 36, 1973: Water Resour Observatory Wind and Solar Radiation Data Water Year 1972

Wyo Univ, Water Resour Res Inst, Water Resour Ser 42, 1972: Water Resour Observatory Wind Data, Water Years 1970 and 1971

MASTER LIST OF SERIAL PUBLICATIONS USED BY POLLUTION ABSTRACTS

AIAA Bull, (Amer Inst of Aeronau and Astronau Inc.), N.Y.

AIAA J, (Amer Inst of Aeronau and Astronau Inc) Easton, PA

AIAA Paper

AIC Review, (Agric Inst of Canada) Ottawa

Academic Des Sci, Paris, Comptes Rendus Serie A: Sci Mathematiques

Academic Des Sci, Paris, Comptes Rendus Serie B: Sci Physiques

Academic Des Sci, Paris, Comptes Rendus Serie C: Sci Chemiques

Academic Des Sci, Paris, Comptes Rendus Serie D: Sci Naturelles

Academy of Natural Sci of Philadelphia, Notulae Naturae
Academy of Natural Sci of Philadelphia, Proc
Achema -- Jahrbuch
Acoust Soc of Amer, J, (Amer Inst of Physics), N.Y.
ACTA Adriatica, (Inst Billogicum Oceonographicum; Oceanografski Inst Split, Yugoslavia
ACTA Anatomia
ACTA Biologica Cracoviensia, Serie Zoologie, (Polask Akademia Nauk, Komisja Biologiczna), Krakow
ACTA Botanica Fennica
ACTA Hydrobiologica, (Polska Akademia Nauk, Zakland BiologII Wod) Krakow
ACTA Hydrophysica, (Akademia Der Wissenschaften, Berlin, Inst fuer Physikalische Hydrographie) Berlin
ACTA Medica Romana, (Faculta di Medicina E Chriurgia, Univ Cattolica del Sacro Cuore) Milan
ACTA Pharmacologica et Toxicologica
ACTA Polytechnica Scandinavica
ACTA Zoologica Lund, Sweden
Acoustica, (Acoust Group of the Physical Soc of London) Stuttgart, Germany
Admiralty Cil Lab, ADL Rep, Cobham, Surrey, England
Adv Metals Res Corp, Rep, Burlington, Mass
Aerojet Booster, (Aerojet-Gen Corp), Azusa, Calif
Aerosol Sci, (Perganon Press), London
Aerosp Medicine (Aerosp Medical Assoc), St. Paul, Minn
Agric Res, (S Carolina, Agric Experiment Station, Clemson)
Agrohemija, (Poslovno Udruzenje Proizvadaca Sredstava Za Hemizaci Ju Poljoprivrede), Belgrade
Agronomy J, (Amer Soc of Agronomy) Wash, D.C.
Air Pollut Control Assoc, J, Pittsburgh
Ajax Intl Corp, News Release, Santa Barbara, Calif
Akademiia Nauk SSSR, Bull, Atmospheric and Ocenaic Physics Series (Amer Geophysical Union), Wash, D.C. (English Translation of Akedimiaa Nauk SSSR, Izvestiia, Fizika Atmosfery I Okeana)
Akademiaa Nauk SSSR, Doklady, Moscow
Alaska, Univ, Goephysical Inst, Final Rep, College
Alaska, Univ, Inst of Arctic Environ Engr, Annu Rep, College
Alaska, Univ, Marine Advisory Bull, College
Albany Law Review
All Clear, Hackensack, NJ
Alternatives
Amer Assoc of Pet Geologists, Bull, Tulsa, Okla
Amer Assoc of Pet Geologists, Map Series, Tulsa, Okla
Amer Astronautical Soc, Paper
Amer Bar Assoc, J
Amer Bar Assoc, J, Chicago
Amer City Magazine
Amer Education, (U.S. Office of Education), Wash DC
Amer Fish Farmer Magazine
Amer Fisheries Soc, Transactions, Wash DC
Amer Forests (Amer Forestry Assoc), Wash DC
Amer Geophysical Union, Transactions, Wash DC
Amer Heritage, The Magazine of History, NY

Amer Ind Hygiene Assoc, J, Ann Aevoe
Amer Inst of Mining, Metall and Pet Engr, Soc of Pet Engr, Prepr, NY
Amer J of Botany, (Botanical Soc of Amer), NY
Amer J of Epidemiology
Amer J of Intl Law (Amer Soc of Intl Law) NY
Amer J of Public Health and the Nation's Health (Amer Public Health Assoc) Boston
Amer J of Vet Res, (Amer Vet Medical Assoc).
Amer Leather Chem Assoc, J
Amer Management Assoc, News, NY
Amer Meteorological Soc, Bull, Boston
Amer Microscopical Soc, Transactions, Columbus, Ohio
Amer Midland Naturalist, (Univ of Notre Dame), Notre Dame, Ind
Amer Naturalist (Amer Soc of Naturalists), Chicago, Ill
Amer Pet Inst, Publication
Amer Philosophical Soc, Transactions, Philadelphia, Penn
Amer Review of Respiratory Disease
Amer Shore and Beach Preservation Assoc, News Letter, Rockvill, MD
Amer Soc for Oceanography, Amer Oceanography, Newsletter, Houston, Texas
Amer Soc of Agric Engr, Paper, St Joseph, Mich
Amer Soc of Civ Engr, Engr Mech Div, J, EM, Ann Arbor, Mich
Amer Soc of Civ Engr, Hydraulics Div, J, GY, Ann Arbor, Mich
Amer Soc of Civ Engr, Sanitary Engr Div, J, SA, Ann Arbor, Mich
Amer Soc of Civ Engr, Soil Mech and Foundations Div, J, SM, Ann Arbor, Mich
Amer Soc of Civ Engr, Tech Memorandum, NY
Amer Soc of Civ Engr, Struct Div, J, St, Ann Arbor, Mich
Amer Soc of Civ Engr, Waterways and Harbors Div, J, WW, Ann Arbor, Mich
Amer Soc of Mech Engr, ASME Publ, NY
Amer Soc of Mech Engr, ASME Standard, NY
Amer Soc of Mech Engr, Transactions, Series A: J of Engr for Power, NY
Amer Soc of Mech Engr, Transactions, Series B: J of Engr for Ind, NY
Amer Soc of Planning Officials, Planning Advisory Serv, Inf Rep, Chicago
Amer Trial Lawyers, J
Amer Univ, Wash, DC, Law Review
Amer Vet Medical Assoc, J, NY
Amer Water Works Assoc, J, NY
Amer Zoologist (Amer Soc of Zoologists(, Utica, NY
Analyst, (Soc for Anal Chem), Cambridge, England
Analytical Chem, (Amer Chem Soc) Wash, DC
Analytical Letters
Animal Behavior (Assoc for the Sud of Animal Behavior) London
Animal Ecology
Animal Kingdom (NY Zoological Soc), Bronx, NY
Animals Academiae Scie Fennicae, Series A, Geologica - Geographica, Helsinki
Annales Botanici Fennici, (Societas Zoologica Botanica Fennica Vanamo) Helsinki
Annales de L'Institut Oceanographique, Paris
Annales Zoolagici Fennici (Societas Zoologica Botanica Fennica Vanamo) Helsinki
Annals of Botany, London

Annals of Occupational Hygiene, (British Occupational Hygiene Soc) NY
Annee Biologique, (Federation Francaise des Societes de Sci Naturelles) Paris
Annuarie Fancais de Droit Intl, (France, Centre Natl de la Recherche Scientifique) Paris
Antarctic J of the United States (Natl Sci Foundation and Dept of Defense) Wash, DC
Anticorrosion Methods and Materials, London
Appl Microbiology, (Amer Soc for Microbiology), Baltimore, MD
Appl Optics (Optical Soc of Amer), Wash DC
Aqua, (State Rivers and Watter Supply Comm), Victoria
Archiv Fuer Fischereiwissenschaft, Hamburg, Germany
Archiv Fuer Hygiene und Bakteriologie
Archiv Fuer Midrobiologie, Berlin
Archives de Zoologie Experimental et Generale, (France, Centre Natl de la Recherche Scientifique), Paris
Archives of Biochem and Biophysics, NY
Archives of Environ Health (Amer Medical Assoc), Chicago
Archivio di Fisiologia, Florence
Archivio de Oceanografia e Limnologia, (Italy, Centra Nationale de Studi Talassografici), Venice
Archivio Zoologico Italiano
Arctic, (Arctic Inst of N Amer), Montreal
Argonne Natl Lab, Environ Sci Rep, Argonne, Ill
Argonne Natl Lab, Translation, Argonne, Ill
Arizona Law Review, (Arizona, Univ, College of Law), Tucson, Ariz
Arkansas, Univ, Water Resour Res Centr, Proj Completion Rep, Fayetteville
Arkansas, Univ, Water Resour Res Centr, Publ, Fayetteville
Arkiv Fuer Mineralogi Och Geologi, (Svenska Vetenskapsakademien) Stockholm
Armed Forces J, Wash, DC
Armed Forces Management, Wash DC
Asian Inst of Tech, Repr, Bangkok
Assoc de Geographes Francais, Paris, Bull
Assoc Intl D'Oceanographie Physique, Publ, Scientifique, Paris
Assoc of Official Analy Chem, J
Astronau and Aeronau, (Amer Inst of Aeronau and Astronau), NY
Atlantic Richfield Manford Co, Rep, Richland, Wash
Atlantic States Marine Fisheries Comm, Marine Resour of the Atlantic Coast, Leaflet, Tallahassee, Fla
Atmospheric Environ, (Pergamon Press), NY
Atoll Res Bull, (Natl Res Counc, Pacific Sci Board) Wash DC
Atomic Absorption Newslwtter, Norwalk, Conn
Atomic Energy of Canada, Ltd, A.E.C.L. Chalk River, Ontario
Atomic Energy of Canada, Ltd, Rep, Ottawa
Atomic Energy Law J
Auckland, NZ Univ, Botany Series, Reprint
Audobon (Natl Audobon Soc), NY
Auk, (Amer Crnithologists' Union) Cambridge, Mass
Australia, Atomic Energy Comm, Rep, Canerra
Australia, Water Resour Council, Water Resour Newsletter, Canberra
Austrailia Commonwealth Sci and Ind Res Organiz, Div of Fisheries and Oceanography, Fisheries Synopsis, Cronulla, N.S.W.

Australia, Commonwealth Sci and Ind Res Organiz, Div of Fisheries and Oceanography, Oceanographical Cruise Rep, Melbourne
Australia, Commonwealth Sci and Ind Res Organiz, Div of Fisheries and Oceanography, Rep, Cronulla, N.S.W., Marine Biological Lab
Australian Chem Engr, Sydney
Australian Chem Processing and Engr, Sydney
Australian Fisheries, Canberra
Australian Geographer, (Geographical Soc of N.S.W.) Sydney
Australian J of Marine and Freshwater Res, (Commonwealth Sci and Ind Res Organiz), East Melbourne
Australian J of Sci, (Australian and New Zealand Assoc for the Adv of Sci), Sydney
Australian J of Zoology, (Commonwealth Sci and Ind Res Organiz) East Melbourne
Australian Law J, Rep, Sydney
Australian Meteorolgical Magazine, (Australia, Bureau of Meteorology), Melbourne
Australian Zoologist, (Royal Zoological Soc of N.S.W.), Sydney
Automobile Manuf Assoc, Inc, News Release, Detroit

Baltic and Intl Mritime Conf, BIMCO Bull
Baltimore Sun
Barcelona, Instituto de Investigaciones Pesqueras, Tech Rep
Battelle Memorial Inst, Columbus, Ohio, Columbus Lab, Final Rep
Battelle Memorial Inst, Columbus, Ohio, Columbus Lab, Phase Rep
Battelle Memorial Inst, Columbus, Ohio, Pacific NW Lab, Rep, Richland, Wash
Battelle Res Outlook, (Battelle Memorial Inst, Columbus Lab), Columbus, Ohio
Beauforita, (Zoological Museum, Univ of Amsterdam), Amsterdam
Bechtel Corp, Summary Rep, Vernon, Calif
Behaviour, Leyden, Netherlands
Beitraege Zur Meereskunde, (Akademie der Wissenschaften, Berlin, Inst fuer Meereskunde), Berlin
Bell Lab Record, NY
Bergen, Norway, Univ, Geophysik Inst, Rep
Bermuda Biological Station for Res, Inc, Special Publ, St Georges West
Betz Indicator
BiJdragen Tot de Dierkunde, (K Zooelogisch Genootschap Natura Artis Magistra), Amsterdam
Biochem J, (Biochem Soc), London
Biochem Pharmacology, (Pergamon Press), London
Biochem, (Amer Chem Soc), Wash DC
Biologia Gallo -- Hellenica, Athens
Biological Bull, (Woods Hole, Mass, Marine Biological Lab), Boston
Bio-Sci, (Amer Inst of Biological Sci), Wash DC
Bird-Banding, A J of Ornithological Investigation, Boston
Boise Cascade Papers
Bollettino di Pesca, Piscicoltura e Idrobiologia, (Italy, Lab Centrale di Idrobiologia), Rome

Bollettino de Zoologia, (Unione Zoological Italiana), Torino
Bologna, Univ, Inst Zoologico, Lab of Biologia Marine e Pesca-Fano, Note
Bolt Beranek and Newman, Inc, Tech Rep, Cambridge, Mass
Bolt Beranek and Newman, Inc, Tech Rep, Van Nuys, Calif
Boston College Ind and Commercial Law Review (Boston College, Boston, Mass, Law School)
Boston Globe
Boston Soc of Civ Engr, J
Bostonica Marina, Hamburg, Germany
Boyce Thompson Inst for Plant Res, Inc, Yonkers, Contributions
Bremerhaven, Germany Inst fuer Meeresforschung, Veroeffentlichungen, Bremen
Breviora, (Meuseum of Comparative Zoology, Harvard College), Cambridge, Mass
British Chem Engr, London
British Columbia, Univ, Law Undergraduate Soc, Law Review, Vancouver
British J of Ind Medicine, (British Medical Assoc), London
British Phycological J, (British Phycological Soc), Glasgow
British Water Supply (British Waterworks Assoc), London
Brookhaven Natl Lab, Upton, NY, Rep
Brooklyn Law Review
Brussels, Univ Libre, Revue
Bucharest, Muzeul Natl de Istorie Naturala "Origore Anipa", Travaux
Buckeye Bull, (Ohio Water Pollut Control Conf)
Buffalo Law Review (Students of the Univ of Buffalo School of Law), Buffalo
Bull de L'Institut de Geologie du Bassin D'Aquitaine
Bull de L'Institut Oceanographique, Musee Oceanographique, Monaco
Bull Geodesique, (Intl Union of Geodesy and Geophysics, Assoc of Geodesy) Paris
Bull of Environ Contamination and Toxicology, (Springer-Verlag), NY
Bull of Legal Developments
Bull of Marine Sci, (Marine Lab, Univ of Miami) Coral Gables, Fla
Business Wekk, NY

CSK Preliminary Data Rep, Cooperative Study of the Kuroshio and Adjacent Regions, (Japanese Oceanographic Data Centr), Tokyo
Cahiers de Biologie Marine, Editions de la Station Biologique de Roscoff, Roscoff, France
Cahiers du Pacifique, (Paris, Museum Natl D'Histores)
Cahiers O.R.S.T.O.M. Oceanographie, (Office de la Recherche Sci et Tech Outre-Mer), Paris
Cahiers Oceanographiques, Bull D'Information, (Serv Hydrographique de la Marine, Comite Central D'Oceanographie et D'Etude des Cotest Paris
Cahners Critical Issue Rep, (Cahners Publ Co), Boston
Calif Dep of Fish and Game, Marine Resour Operations, State Fisheries Lab, Cruise Rep, Terminal Island
Calif Dep of Fish and Game, Marine Resour Operations, State Fisheries Lab, Flight Rep, Terminal Island
Calif Resour Agency, State Water Resour Control Board, Publ
Calif State College, Humboldt, Rep

Calif, State College, San Diege, Thesis
Calif, State College, San Francisco, Dept of Biology, Finial Tech Rep,
Calif, State Water Resour Control Board, Publ, Sacramento
Calif, Univ, Calif Agriculture
Calif, Univ, College of Engr, Comm on Ocean Engr, Tech Rep, Berkeley
Calif, Univ, College of Engr, Earthquake Engr Lab, Tech Rep, Berkeley
Calif, Univ, College of Engr, Hydraulic Engr Lab, Tech Rep, Berkeley
Calif, Univ, College of Engr, Tech Rep, BErkeley
Calif, Univ, Inst of Marine Resour, IMR Ref, Berkeley, Los Angeles, La Jola
Calif, Univ, Lawrence Radiation Lab, Livermore, Prepr
Calif, Univ, Lawrence Radiation Lab, Livermore, Translation
Calif, Univ, Lawrence Radiation Lab, Livermore, UCRL (Reps) Berkeley
Calif, Univ, Proj Clean Air, Res Rep, Riverside
Calif, Univ, Sanitary Engr Res Lab, Annu Rep, Berkeley
Calif, Univ, Sanitary Engr Res Lab, News Quarterly, Berkeley
Calif, Univ, Sanitary Engr Res Lab, Oratory, Rep, Berkeley
Calif, Univ, Scripps Inst of Oceanography, La Jola, Bull, Berkeley
Calif, Univ, Scripps Inst of Oceanography, La Jolla, Marine Physical Lab, Ref
Calif, Univ, Scripps Inst of Oceanography, La Jolla, News Release
Calif, Univ, Scripps Inst of Oceanography, La Jolla, S10 Ref
Calif, Univ, Scripps Inst of Oceanography, La Jolla Visibility Lab, Rep
Calif, Univ, Sea Water Conversion Lab, Rep
Calif, Univ, Irvine, Final Rep
Calif, Univ, Irvine, Prepr
Calif, Univ, Los Angeles, Dept of Engr, Rep
Calif, Univ, Los Angeles, Lab of Nuclear Medicine and Radiation Bio, Rep
Calif, Univ, Los Angeles, Sch of Engr and Appl Sci, Biotechnol Lab, Tech Rep
Calif, Univ, Los Angeles, Sch of Engr and Appl Sci, Water Resour Centr Desalination Rep
Calif, Univ, Los Angeles, Sch of Law, UCLA Law Review
Calif Academy of Sci, Proc, San Francisco
Calif Air Environ, (Statewide Air Pollut Centr) Riverside
Calif Air Quality Data (Calif Air Resour Board) Berkeley
Calif Air Resourc Board, Annu Rep, Sacramento
Calif Air Resourc Board, Bull, Los Angeles
Calif Engr
Calif Farmer, Los Angeles
Calif Fish and Game, (Calif, Dept of Fish and Game), Sacramento
Calif Inst of Tech, Pasadena, Div of Engr and Appl Sci, Tech Rep
Calif Inst of TEch, Pasadena, Soil Mech Lab, Rep
Calif Inst of Tech, Pasadena, W.M. Keck Lab of Environ Health E gr, Annu Rep
Calif Inst of Tech, Pasadena, W.M. Keck Lab of Hydraulics and Water Resourc, Rep
Calif Medicine
Calif Oil World, Los Angeles
Calif State Bar, J

Calif Vector Views, (Calif Bureau of Vector Control) Berkeley
Calif Water Pollut Control Assoc, Bull, Los Angeles
Calif Western Law Review (Calif Western Univ), San Diego
Calif Health, (Calif Dep of Public Health), Berkeley
Cambridge Acoust Assoc, Inc, Final Rep, Cambridge, Mass
Cambridge Law J
Canada, Bedford Inst of Oceanography, Rep A.O.L., Darmouth, N.S.
Canada, Bedford Inst of Oceanography, Rep B.I.O., Ottawa
Canada, Def Res Board, Def Res Establish, Repring, Victoria, B.C.
Canada, Def Res Board, Def Res Telecommunications Establish, Tech Note, Ottawa
Cadada, Def Res Board, Translation, Ottawa
Cana, Dept of Energy, Mines and Resourc, Inland Waters Branch, Rep Series, Ottawa
Canada, Dep of Energy, Mines and Resourc, Inland Waters Branch, Sci Series, Ottawa
Canada, Dept of Energy, Mines and Resourc, Inland Waters Branch, Tech Bull, Ottawa
Canada, Dept of Fisheries, Resour Dev Branch, Progress Rep, Halifax, N.S.
Cadada, Dept of Fisheries and Forestry, Candadian Forestry Serv, Forest Products Lab, Inf Rep, Vancouver, B.C.
Canada, Dept of Fisheries and Forestry, Fisheries of Canada, Ottawa
Canada, Dept of Natl Health and Welfare, Radiation Protect Div, Publ, Ottawa
Canada, Fisheries Res Board, A.R.O., Circular, Halifax, N.S.
Canada, Fisheries Res Board, Bull, Ottawa
Canada, Fisheries Res Board, J, Ottawa
Canada, Fisheries Res Board, Manuscr Rep Series (Oceanographic and Limnological) Ottawa
Canada, Fisheries Res Board, Tech Rep, Biological Station, Nanaimo, B.C.
Canada, Fisheries Res Board, Translation Series
Canada, Marine Sci Branch, Manuscr Rep Series, Ottawa
Canadian Bar Review
Canadian Counc of Resource Ministers, Refs, Montreal
Canadian Counc of Resource Ministers, Sources, Montreal
Canadian Entomologist
Canadian J of Botany, Ottawa
Canadian J of Chem Engr, (Chem Inst of Canada), Ottawa
Canadian J of Earth Sci, Ottawa
Canadian J of Microbiology, (Natl Res Counc, Canada), Ottawa
Canadian J of Pharmaceutical Sci, (Canadian Pharmaceutical Assoc), Toronto
Canadian J of Plant Sci, (Agric Inst of Canada), Ottawa
Canadian J of Public Health, (Canadian Public Health Assoc; Ontario Health Officers Assoc), Toronto
Canadian J of Soil Sci, (Agric Inst of Canada), Ottawa
Canadian J of Zoology, Ottawa
Canadian Medical Assoc, Toronto, J
Canadian Oceanographic Data Centre, Data Record Series, Ottawa
Canadian Plastics, Ontario

Cape Town, Univ of Cape Town, Inst of Oceanography, Collected Repr
Caribbean J of Sci, (Puerto Rico, Univ, Inst of Caribbean Studies) Mayaguez
Case Western Preserve Law Review
Catholic Univ of Amer, Civ Engr and Mech Dep, Stress Analy Lab, Rep, Wash, DC
Catholic Univ of Amer, Hydromech Lab, Final Rep, Wash DC
Catholic Univ of Amer, Inst of Ocean Sci and Engr, Rep, Wash DC
Centr for the Environ and Man, Inc, Rep, Hartford, Conn
Central Marine Fisheries Res Inst, Bull, Mandapan Camp, India
Centrallaboratorium AB, Helsingfors, Finnish Pulp and Paper Res Inst, Rep
Centre de Recherches de Pau, Bull, France
Centre de Recherches Oceanographiques O.R.S.T.O.M. Cocument Sci Provisoire Abidjan
Chem 26 Paper Processing, (Hale Publ Co), Stamford, Conn
Chem and Engr News, (Amer Chem Soc), Wash DC
Chem Engr, Albany, NY
Chem Engr Progress
Chem Geology, (Elseview Publ Co), Amsterdam
Chem Processing, Chicago
Chem Processing, London
Chem Week, NY
Chemico World
Chemie Fuer Labor und Betrieb, Frankfurt AM Main
Chem and Ind, (Soc of Chem Ind), London
Chesapeake Sci, (Maryland, Univ, Natural Resourc Inst, Chesapeak Biolog Lab), Solomons Island, MD
Chicago, Univ, Dept of Geography, Res Paper
Chicago, Univ, Dep of the Geophysical Sci, Tech Rep
Chicago Tribune
Christian Sci Monitor (Western Ed), Boston, Mass
Chromosoma, Berlin, Vienna
Chronmy Przyrode Ojczysta, (Polskiej Akademii Nauk, Panstwomej Rady Ochrony Przrody), Panstwowe Wydawnictwo Naukowe
Citrograph, Redlands, Calif
Civ Engr, (Amer Soc of Civ Engr), NY
Clean Air (Natl Soc for Clean Air), Brighton, England
Clean Waters for Ohio (Ohio Water Pollut Control Board) Columbus, Ohio
Clemson Univ, Water Resourc Res Inst, Rep, Clemson, S Carolina
Clinical Toxicoloty, (Marcel Dekker), NY
Coastal Engr in Japan (Japan Soc of Civ Engr), Tokyo
Coastal Res Notes, (Fla State Univ, Dept of Geology, Tallahassee
Colorado, State Univ, Fort Collins, College of Engr, Fluid Mech Program, Fluid Dyn and Diffusion Lab, Rep
Colorado, State Univ, Fort Collins, Dept of Animal Sci, Tech Progress Rep
Colorado, State Univ, Fort Collins, Sanitary Engr Papers
Columbia Univ, Henry Krumb Sch of Mines, Ocean Engr Div, Tech Rep, NY
Columbia Univ, Hudson Lab, Dobbs Ferry, NY, Tech Rep
Columbia Univ, Lamont Geological Observatory, Palisades, NY Final Rep

Columbia Univ, Lamont Geological Observatory, Palisades, NY, Map
Columbia Univ, Lamont Geological Observatory, Palisades, NY, Tech Rep
Columbia Univ, Offic of Public Inf, News Release, NY
Columbia Univ, Sch of Law, Law Review, NY
Combustion, (Combustion Publ Co Inc), NY
Combustion Engr Inc, Progress (Combustion Engr Inc), NY
Combustion Sci and Technol, (Gordon and Breach, Sci Publ Ltd), Belfast
Commerce Business Daley
Commercial Fisheries Review, (U.S. Fish and Wildlife Serv), Wash
Comparative Biochem and Physiology, NY
Compost Sci, Emmaus, Pa
Comptroller General of the United States, Rep, Wash DC
Computing Rep
Condor: A Magazine of Western Ornithology, (Cooper Ornithological Club of Calif), Santa Clara
Congressional Record
Conn, Univ, Inst of Water Resourc, Rep, Storrs
Conn Waw Review
Conservation Law Notes
Conservation News, (U.S. Natl Wildlife Serv), Wash DC
Conservationist, (N.Y. State Dept of Environ Conservation), NY
Contributions to Mineralogy and Petrology
Copeia, (Amer Soc of Ichthyologists and Herpetologist), Northridge, Calif
Cornell Univ, Centr for Enciron Quality Management, Rep, Ithaca, NY
Cornell Univ, Law Sch, Law Review
Cornell Univ, NY State Vet College, Final Rep, Ithaca
Cornell Univ, Water Resourc and Marine Sci Centr, Tech Rep, Ithaca, NY
Cornell Vet, (Cornell Univ, NY State Vet College), Ithaca
Corpus Christi Geological Soc, Bull, Texas
Corrosion (Natl Assoc of Corrosion Engr), Houston, Tex
Corrosion Prevention and Control, London
Council of Planning Librarians, Exchange Bibliography
Crolife, Minneapolis
Crustaceana, Leyden, Netherlands
Cupana, Venezuela, Univ de Oriente, Inst Oceanografico, Boletin
Current Digest of Soviet Press, Current Soviet Policies, the Document Record of the Communist Party Congress, NY
Current Sci (Current Sci Assoc, Bangalore, India
Cushman Foundation for Foraminiferal Res, Contributions, Wash DC

Dana Rep, (Calsberg Foundations Ocianographical Expedition Round the World, 1928-30, and Previous "Dana" Expeditions), Copenhagen
Dansk Naturhistorik Forening, Copenhagen, Videskabelige Meodelelser
Das Gas - Unc Wasserfach
Data, Wash DC
Deep-Sea Res and Oceanographic Abstr, London
Delaware, Water and Air Resourc Comm, Progress Rep, Dover
Delaware, Water and Air Resourc Comm, Water Pollut Control Regu, Dover
Delaware, Water and Air Resourc Comm, Report, Dover
Delaware River Basin Comm, Annu Rep, Trenton
Denmark, Atomenergikommissionen, Risce Rep

Denver Post
Desalination, (Elsevier Publ Co), Amsterdam
Detroit News
Deutsche Hydrographische Zeitschrift, (Deutsches Hydrographisches Inst) Hamburg, Germany
Developmental Biology, NY
Dillingham Corp, Appl Oceanography Div, Final Rep, La Jolla, Calif
Dillingham Corp, Appl Oceanography Div, Summary, La Jolla, Calif
Dock and Harbour Authority, London
Dornier Post, English Ed, Munich, Germany
Dow Chem Co, News Released, Midland, Mich
Down to Earth, (Dow Chem Co), Midland, Mich
Duke Law J, (Duke Univ, Sch of Law), Durham, NC
Du Pont de Nemours (E.I.) and Co, Savannah River Lab, Rep, Aiken, SC
Ducuesne Univ, Law Review, Pittsburgh

EG&G Intl, EG&G Monitor, Yearbook
EG&G Intl, Geodyne Div, Davy Jones, Newsletter
Earl and Wright Consulting Engr, Progress Rep, San Francisco, Calif
Earth and Planetary Sci, Letters, Amsterdam
Eastman Kodak Co, Kodak Publ, Rochester, NY
Eastman Kodak Co, News Service, News Release, Rochester, NY
Ecology, (Ecological Soc of Amer) Brooklyn, NY
Effluent & Water Treatment J, London
Electrochem Soc, J, Baltimore
Electronic Assoc, Inc, Bull, West Long Branch, NJ
Electronics News, NY
Electronics, NY
Electronics Weekly, London
Electronics World, NY
Emu: A Quarterly Magazine to Popularize the Study Protection of Native Birds, (Royal Australian Ornithological Union), Melbourne
Endeavor, London
Enfo
Energia Nucleare, (Centro Informazioni Tudi Esperienze, Milan)
Engr, London
Engring, London
Engr and Mining J, NY
Engr Foundation, NY, Coordinating Comm on Air Pollut, Lit Search
Engr J, (Engr Inst of Canada), Montreal
Engr News-Record
Engr Opportunities, Evanston, Ill
Environ, (Sci Inst for Publid Info)
Environ: Planning and Conservation in Sweden, (Swedish Info Serv), NY
Environ Reporter
Environ Affairs
Environ Control and Safe Management, Morristown, NJ
Environ Design
Environ Engr, (Soc of Environ Engr), London
Environ Quality Magazine, (Environ Awareness Assoc, Inc), Los Angeles Calif

Environ Res, (Academic Press), NY
Environ Sci and Tech, (Amer Chem Soc), Wash DC
Eripaninos Vestialous, Helsinki
Eernaerungs-Umshau, (Deutsche Gesellschaft Fuer Ernaehrung), Frankfurt AM Main
ESSA
ESSO Res and Engr Co, Govern Res Div, Rep, Linden, NJ
ESSO Res and Engr Co, News Release, Linden, NJ
European Shipbuilding, Oslo
Evening Tribune, San Diego, Calif
Explorer: A Magazine of the Natural Sci, (Cleveland Museam of Natural History), Ohio

FAO Fisheries Circular, (Food and Agric Organiza of the United Nations, Fisheries Div), Rome
FAO Fisheries Rep, (Food and Agric Organiza of the United Nations, Fisheries Div), Rome
FAO Fisheries Synopsis (Food and Agric Organiza of the United Nations, Fisheries Div), Rome
FAO Yearbook of Fishery Statistics, Annuaire Statistique Des Peches, Anuario Estadistico de Pesca, Rome
FAO General Fisheries Counc for the Mediterranean, Studies and Reviews, Rome
Fram and Food Res, Dublin
Fed Law Review, (Australian Natl Univ, Sch of General Studies, Faculty of Law), Canberra
Fertiliser Assoc of Ireland, Proc
Finland, Merentutkimuslattoksen Julkaisu, Havsforskningsinstitutets Skrift, Helsinki
Fininish Paper and Timber, (Suomen Puunjalostusteollinsunden Keskuslittoii Julkaiseme), Helisinfors
Fish Boat, New Orleans, LA
Fish Trades Gazette, London
Fishing News Intl, London
Flinders Univ of S Australia, Horace Lamb Centre for Oceanographical Res, Survey Paper, Bedford Park, S Australia
Florida, State Dept of Air and Water Pollut Control, Newsletter
Florida, Univ, Gainesville, Dept of Speech, Communications Sci Lab, Rep
Florida, Univ, Gainesville, Engr Progress at the Univ of Florida,
Florida, Univ, Gainesville, Water Resourc Res Centr, Publ
Florida Academy of Sci, Gainesville, Quarterly J, Detroit
Fluoride, (Intl Soc for Fluoride Res)
Food and Cosmetics Toxicology, (British Ind Biological Res Assoc), London
Foras Taluntais, Plant Sci and Crop Husbandry Div, Res Rep, Dublin
Forbes, NY
Ford Foundation, News Release
Forensic Quarterly
Forest Sci: A Quarterly J of Res and Tech Papers, (Soc of Amer Foresters), Wash DC
Forstwissenschaftliches Centralblatt, Hamburg, Germany

Fortune, NY
France, Bureau de Recherches Geologiques et Mineres, Bull, Paris
France, Commissariat A L'Energie Atomique, Rapport C.E.A.
France, Commissariat A L'Energie Atomique, Serie 'Bibliographies"
France, Inst Geographique Natl, Cartes en Service
France, Ministere de la Sante Publique et de la Securite Sociale, Service Central de Protection Contre les Raycnnepents Ionisants, Rapport D'Activitite
France, Office de la Recherche Sci et Tech Outre-Mer, Memoires
Frankfurter Allgemeine
II Friuli Mecico
Frlm the State Capitals, Sweage and Waste Disposal, Rep, Asbury, NJ

Galethea Rep, (Danske Dybhavsekspedition Joiden Rundt, 1950-52; Sci Results of the Danish Deep-Sea Expedition Round the World, 1950-52), Copenhagen
Gas-Wasser-Abwasser
General Contractor, (Assoc, of General Contractors of Amer), San Diego
General Dynamics, Convair Div, Rep, San Diego, Calif
General Dynamics, Electr Boat Div, Rep, Groton, Conn
Generay Dynamics, Electr Boat Div, Summary, Groton, Conn
General Elect Co, Major Appliance Div, Tech Info Series
Genetical Res, (Cambridge Univ Press), London
Gejow, Museo Civico di Storia Naturale "Giacomo Doria", Annali
Geochimica et Cosmochimica Acta, NY
Geographical J, (Royal Geographical Soc), London
Geological Assoc of Canada, Proc
Geological Magazine, Hertord, England
Geological Soc of Amer, Bull, NY
Geological Soc of Amer, Special Papers, NY
Geological Soc of London, Quarterly J
Geologiska Foereningen I Stockholm, Foerhandlingar
Geologist'sAssoc, Proc, Colchester, England
Geonautics, Inc, Final Rep, Falls Curch, VA
Geonautics, Inc, Interim Rep, Falls Curch, VA
Geophysical J, (Royal Astronomical Soc), London
Geophysical Prospecting (European Assoc of Exploration Geophysicists), The Hague
Geophysics, (Soc of Exploration Geophysicists), Tulsa, Okal
George Washington Univ, Wash DC, Program of Policy Studies in Sci and Tech, Occasional Paper
George Washington Univ, Wash DC, Program of Policy Studies in Sci and Tech, Staff Discussion Paper
Georgia, Univ, College of Agric, Rep (of the) Experiment Stations
Georgia Operator
Georgia's Health, (Georgia Dept of Public Health), Atlanta
Georgia State Bar, J
Geotechnique, London
Geotimes, (Amer Geological Inst), Wash DC
Ghent, Rijksfakulteit Landbouwwetenschappen, Mededelingen

Giorobiologicheskii Zhurnal, (Akademia Nauk URSR, Kiev, Otdelenie Obshchei Biologii)
Gigiena I Sanitariya
Gt.Brit, Ministry of Tech, Natl Survey of Smoke and Sulphur Dioxide, Monthly Mummary
Gt Brit Ministry of Tech, Notes on Water Pollution
Gt Brit Ministry of Tech, Warren Spring Lab, Air Pollut Abstr
Gt Brit Ministry of Tech, Warren Spring Lab, Deposit Gauge and Lead Dioxide Observations
Gt Brit Ministry of Tech, Warren Spring Lab, Monthly Summary of Observa
Gt Brit Ministry of Tech, Water Pollut Res Lab, Tech Paper
Gt Brit Natural Environ Res Council, NERC News J, London
Gt Brit White Fish Authority, Res Bull, London
Ground Water, (Natl Water Well Assoc), Urbana, Ill
Gulf General Atomic, Inc, Rep, San Diego, Calif
Gulf Res Rep, (Gult Coast Res Lab), Ocean Springs, Miss

Hach Chem Co, Rep, Ames, Iowa
Haifa, Ha-Tahanah Le-Hecker Ha-Dayig Ha-Yahi, Bull
Harvard Civil Rights Law J
Harvard Intl Law Review
Harvard J on Legislation
Harvard Law Review
Harvard Univ, Museum of Comparative Zoology, Bull, Cambridge, Mass
Harvard Univ, School of Public Health, Harvard Air Cleaning Lab, Cambridge, Semiannu Progress Rep
Hastings Law J
Hastings Law Review, San Francisco
Hawaii, Univ, Honolulu, Dept of Ocean Engr, J.F.K. Look Lab of Oceanographic Engr, Look Lab/Hawaii
Hawaii, Univ, Honolulu, Final Rep
Hawaii, Univ, Honolulu, Inst of Geophysics, Data Rep
Hawaii, Univ, Honolulu, Inst of Geophysics, Final Rep
Hawaii, Univ, Honolulu, Inst of Geophysics, Rep
Hawaii, Univ, Honolulu, School of Medicine, Dept of Physiology, Sea Grant
Hawaii, Univ, Honolulu, Water Resourc Res Centr, Annu Rep
Hawaii, Univ, Nonolulu, Water Resourc Res Centr, Tech Rep
Health Aspects of Pesticides
Health Physics, NY
Heating, Piping and Air Conditioning
Helglolaender Wissenschaftliche Meeresuntersuschungen, Biologische Anstalt Helgoland, Hamberg, Germany
Herpetologica, Hokkaido Daigaku, Sapporo, Japan, Rigakubu, Daiso Kenkyujo, Muroran, Sci Papers of the Inst of Algological Res
Hokkaido Daigaku, Sapporo, Japan, Suisangakubu, Hakodate, Bull
Hokkaido Daigaku, Sapporo, Japan, Suisangakubu, Hakodate, Memoirs
Honeywell Inc, Syst and Res Div, Res Dept, Final Rep, St Paul, Minn
Houston Chronicle
Hovering Craft and Hydrofoil
Howard Law J, Wash DC
Hubble Way, (Hubble Oil & Refining Co)

Hydro Delft (Delft Hydraulics Lab), Waterloopkundig Lab, Delft, Netherlands
Hydrobiologia, The Haugue
Hydrocarbon Processing
Hydronautics, Inc, Tech Rep
Hydroscope, Bull of SW Florida Water Management Distr
Hydrospace (Grampian Press), London

IEEE Spectrum (Inst of Elect and Electron Engr), NY
IEEE Transactions on Aerosp and Electron Syst, (Inst of Elect and Electron Engr, Group on Aerosp and Electron Syst), NY
IEEE Transactions on Geoscience Electron, (Inst of Elect and Electron Engr, Prof Tech Group on Geoscience Electron), NY
L'Igiene Moderna, (Univ di Padova, Inst di Igiene)
IMCO Bull, (Itner Governmental Maritime Consultative Organiza) London
ISA J, (Instru Soc of Amer), Pittsburgh, Pa
ISA Transactions (Instru Soc of Amer), Pittsburgh, Pa
IIT Res Inst, Tech Centr, Final Rep, Chicago, Ill
IBIS, (British Ornithologists Union), London
Idaho Nuclear Corp, Natl Reactor Testing Station, Rep, Idaho Falls
Ill State Geological Survey, Circular, Urbana
Ill, State Geological Survey, Environ Geology Notes, Naperville
Ill, State Geological Survey, Repr Series
Ill, Univ, College of Vet Medicine, Dept of Vet Physiology and Pharmacology, Progress Rep, Urbana
Ill, Univ, Dept of Theoritical and Appl Mech, T.A.M. Rep, Urbana
Ill, Univ, Water Resourc Centr, Res Rep, Urbana
Ill, Water Survey, Rep, Investigations, Urbana
Ill, Water Survey, Res Rep, Urbana
Ill Res, (Ill Agric Experiment Station, Urbana)
Indian Academy of Sci, Proc, Section A, Gangalore
Indian Academy of Sci, Proc, Section B, Bangalore
Indian J of Chem, (Council of Sci and Ind Res), New Delhi
Indian J of Environ Health, Nagpur
Indian J of Experimental Biology, New Delhi
Indian J of Meteorology and Geophysics, Delhi
Indian J of Tech, (Council of Sci and Ind Res), New Delhi
Indiana, Univ, Water Resourc Res Centr, Rep of Investigation
Indiana Legal Forum
Industrial and Engr Chem, Fundamentals, (Amer Chem Soc), Wash DC
Indust and Engr Chem, Process, Design and Development, (Amer Chem Soc), Easton, Pa
Indust and Engr Chem, (Amer Chem Soc), Wash DC
Indust Medicine and Surgery, Miami, Fla
Indust Photography, NY
Indust Res, Chicago
Indust Water Engr Minneapolis
Innerspace
Inst Fundamental D'Afrique Noire, Bull, Serie A: Sci Naturelles, Dakar
Inst Natl de la Sante et de la Recherche Medicale, Bull, Paris
Inst Royal Meteorologique de Belgique, Inst H'Gygiene et D'Epidemiologie, Bull Mensuel, Brussels

Inst of Fuel, London, J
Inst of Marine Engr, London, Transactions
Inst of Navigation, London, J
Inst of Paper Chem, Bibliographic Series, Appleton, Wisc
Inst of Retro, London, J
Inst of Water Pollut Control, Conf Paper, London
Inst of Water Pollut Control, J, London
Inst of Civ Engr, London, Paper
Inst of Civ Engr, London, Proc
Inst of Mining and Metall, Mining and Petro Geology Sect, Paper, London
Inst of Public Health Engr, J, London
Inst of Water Engr, London, J
Inst Espanol de Odeanografia, Bull, Madrid
Inst Espanol de Oceanografia, Trafajos, Madrid
Inst Voor Gezondheiostechniek Tno, de Ingenieru, The Hague, Netherlands
Instrument News (Perkin-Elmer Corp), Norwalk, Conn
Instrumentation Tech, (Instrument Soc of Amer), Pittsburgh
Inter-Amer Tropical Tuna Comm, Bull, La Jolla, Calif
Inter-Amer Tropical Tuna Comm, Translation, La Jolla, Calif
Inter-Govern Maritime Consultative Organiz, London, Rep, Annu
Intl and Comparative Law Quarterly, (Soc of Comparative Legislation), London
Intl Assoc of Theoretical and Appl Limnology, Mitteilungen, Communications, Stuttgart
Intl Atomic Energy Agency, Prepr, Vienna
Intl Atomic Energy Agency, Radioactivity in the Sea Publ, Vienna
Intl Atomic Energy Agency, Reprint, Vienna
Intl Atomic Energy Agency, Safety Series, Vienna
Intl Comm for the NW Atlantic Fisheries, Spec Publ, Halifax, N.S.
Intl Counc for the Exploration of the Sea, Cooperative Res Rep, Copenhagen
Intl Counc of Sci Unions, Sci Comm on Oceanic Res, Proc, La Jolla, Calif
Intl Hydrographic Review, (Intl Hydrographic Bureau), Monaco
Intl J of Appl Radiation and Isotopes, London
Intl J of Environ Studies
Intl J of Immunochem, (Pergaman Press), Oxford
Intl J of Solids and Struc, NY
Intl Law and Politics
Intl Lawyer, (Amer Bar Assoc, Sect of Intl and Comparative Law)
Intl Legal Materials, Current Documents, Wash DC
Intl Marine Sci, (United Nations Educational, Sci and Cultural Organiz), Paris
Intl N Pacific Fisheries Comm, Bull, Vancouver
Intl Pacific Halibut Comm, (U.S. and Canada), Rep, Vancouver
Intl Pacific Halibut Comm, (U.S. and Canada) Tech Rep, Vancouver
Intl Pacific Salmon Fisheries Comm, (U.S. and Canada), Progress Rep, New Westminister
Intl Shipbldg Progress, Rotterdam
Intl Jahrbuch Chemische Industrie, Solothurn, Switzerland
Interstate Comm on the Potomac River Basin, News Letter, Wash DC
Interstate Sanitation Comm, Rep, NY
Investigation Pesquera, (Spain Consejo Superior de Investigaciones Cientificas, Inst de Investigaciones Pesqueras), Barcelona

Iowa, State Univ of Sci and Tech, Ames, Ames Lab, Res and Develop Rep
Iowa, Univ, Inst of Hydraulic Res, Progress Rep, Iowa City
Iowa, Univ, State Hygienic Lab, Rep, Iowa City
Iowa Law Review
Israel, S Red Sea Expedition, Rep, Sea Fisheries Res Station, Bull
Italy, Comitato Nazionale per L'Energia Nucleare, Rep, Rome
Italy, Consiglio Nazionale Delle Ricerche, Commissione Italiana del
  Comitato Internazionale de Geogisica, Serie IGC: Publ, Rome
Italy, Consiglio Nazionale Delle Ricerche, Commissione Italiana per la
  Oceanografia, Serie A: Raccolta Dati Oceanografici, Rome
Italy, Consigio Nazionale Delle Ricerche, Commissione Italiana per la
  Oceanografia, Serie B: Risorse Marine E del Fondo Marino, Programma
  di Ricerca, Rome
Izzaak Walton Outdoor Amer

JEEE: Japan Electronic Engr, Tokyo
Japan, Far Seas Fisheries Res Lab, Bull, Shimizu
Japan, Sea Regional Fisheries Res Lab, Niigata, Bull
Japanese Soc of Sci Fisheries, Bull
Johns Hopkins Univ, Baltimore, MD, Annu Summ Rep
John Hopkins Univ, Chesapeak Bay Inst, Annapolis, MD, Ref
John Hopkins Univ, Chesapeake Bay Inst, Annapolis, MD, Tech Rep
John Hopkins Univ, Dept of Geography and Environ Engr, Rep, Baltimore MD
J de Conchyliologie, Paris
J du Couseil, (Intl Counc for the Exploration of the Sea)
J of Agric and Food Chem, (Amer Chem Soc), Easton, Pa
J of Air Law and Commerce, Chicago
J of Aircr, (Amer Inst of Aeronau and Astronau), Easton, Pa
J of Animal Ecology, (British Ecological Soc), London
J of Appl Bacteriology, (Soc for Appl Bacteriology), London
J of Appl Ecology, (British Ecological Soc), Oxford, England
J of Appl Meteorology, (Amer Meteorological Soc), Boston
J of Appl Physics, (Amer Inst of Physics), NY
J pf Auditory Res, Groton, Conn
J of Bacteriology, (Amer Soc for Microbiology), Baltimore, MD
J of Biological Chem, (Amer Soc of Biological Chem), Baltimore, MD
J of Chem and Engr Data, (Amer Chem Soc), Wash DC
J of Chromatography, Amsterdam
J of Clinical Pharmacology, Albany, NY
J of Dairy Sci, (Amer Dairy Sci Assoc), Baltimore
J of Econimic Entomology, (Entomological Soc of Amer)
J of Environ Health, (Natl Environ Health Assoc), Denver, Colorado
J of Environ Sci, (Inst of Environ Sci), Los Angeles, Calif
J of Experimental Biology, London
J of Experimental Marine Biology and Ecology, (N Holland Publ Co),
  Amsterdam
J of Experimental Zoology, (Wistar Inst of Anatomy and Biology), Philadelphia, Pa
J of Fish Biology, (Academic Press), London

J of Fluid Mech, London
J of Forestry
J of Geology, Chicago
J of Geophysical Res, (Amer Geophysical Union), Wash DC
J of Claciology, (British Claciological Soc), Cambridge, England
J of Hydraulic Res, J de Recherches Hydrauliques, (Intl Assoc for Hydraylic Res), Delft
J of Hydronautics (Amer Inst of Aeronau and Astronau), Easton, Pa
J of Hygiene, Cambridge, England
J of Intertebrate Pathology, (Academic Press, Inc), NY
J of Japanese Botany, Tokyo
J of Law Reform
J of Mammalogy, (Amer Soc of Mamalogists), Lawrence, Kansas
J of Marine Res, (Sears Foundation for Marine Res, Bingham Oceanographic Lab, Yale Univ), New Haven, Conn
J of Marine Sci, (Marine Sci Inst), Byou La Batre, Alabama
J of Maritime Law and Commerce
J of Materials, (Amer Soc for Testing and Materials), Philadelphia, Pa
J of Paleontology, (Soc of Economic Paleontologists and Mineralogists; Paleontological Soc), Tulsa, Okal
J of Parasitology, (Amer Soc of Parasitologists), Lawrence, Kansas
J of Petro Tech, (Amer Inst of Mining and Metall Engr, Petro Branch), Dallas, Tex
J of Phycology, (Phycological Soc of Amer), Baltimore
J of Physical Chem, (Amer Chem Soc), Wash DC
J of Protozoology, (Soc of Protozoologists), NY
J of Radiation Res, (Japan Radiation Res Soc), Tokyo
J of Sci and Food Agric
J of Sedimentary Petrology, (Soc of Economic Paleontologists and Mineralogists), Tulsa, Okal
J of Ship Res, (Soc of Naval Architects and Marine Engr), NY
J of Soil and Water Conservation, (Soil Conservation Soc of Amer), Baltimore, MD
J of Sound and Vibr, London
J of the Atmospheric Sci, (Amer Meteorological Soc), Boston
J of Urban Law
J of Wildlife Diseases
J of Wildlife Management, (Wildlife Soc), Wash DC
J of Zoology, (Zoological Soc of London), London
Joy Manuf Co, Denver Equip Deiv, Tech Bull, Denver, Colorado
Joy Manuf Co, Western Precipitation Div, Bull, Los Angeles, Calif
Judge Advocate General, J

Kansas, Univ Paleontological Inst, Contributions, Lawrence
Kansas, Univ, Sci Bull, Lawrence
Kansas Academy of Sci, Transactions
Kansas City Law Review, (Univ of Missouri)
Kansas City Star
Kansas City Times
Kellogg World, (W.M. Kellogg Co), Houston, Tex

Kentucky, Univ, Water Resouc Inst, Res Rep, Lexington
Korrespondenz Abwasser, (Informationsblatt fuer das Abwasserwesen)
Kyoto Daigaku, Inst of Insect Control, Botyo-Kagaku
Kyoto Daigaku, Misaki Rinkai Kenkyojo, Kenkyo Hokoku, Maizuru, Japan, Spec Rep

La Punta, Puru (Lima), Inst del mar del Puru, Bull
Lab Practice, London
Lance, Boston and London
Land and Water Law Review
Layngoscope
Law and Contemp Problems Series, (Duke Univ, Sch of Law), Dobbs Ferry, NY
Lawyer of the Amer, (Inst for Inter-Amer Legal Studies, Univ of Miami, Sch of Law)
Leben, (Biologie Verlag), Hamburg
Le Monde, Paris
Let's Live, (Oxford Ind, Inc), Los Angeles
Leyden, Rijksmuseum Van Natuurlijke Historie, Zoologische Verhandelingen
Life, Chicago
Limnology and Oceanography, (Amer Soc of Limnology and Oceanography) Ann Arbor, Mich
Linnean Soc of London, J, Zoology
Lisbon, Junta do Investigacoes do Ultramar, Centro de Biologia Aquatica Tropical, Notas Mimeografadas
Litton Syst, Int, Adv Marine Tech Div, Final Rep, Culver City, Calif
Litton Syst, Inc, Environ Syst Div Tech Rep, Bethesda, MD
Lockheed Aircr Corp, Lockheed Missiles and Space Co, Lockheed Res Lab, Sunnyvale, Calif
Lockheed Aircr Corp, Lockheed Missiles and Space Co, News Release, Sunnyvale, Calif
Lockheed Aircr Corp, Lockheed Missiles and Space Co, Ocean Syst Lab, Rep, Sunnyvale, Calif
Lockheed Aircr Corp, Lockheed Missiles and Space Co, Underwater Missile Facility, Final Tech Rep, Sunnyvale, Calif
London Times
Los Angeles, Uni of S. Calif, Allan Hancock Foundation, Allan Hancock Momographs in Marine Biology
Los Angeles, Univ of S Calif, News Release
Los Angeles Bar Bull
Los Angeles County Museum, Los Angeles, Bull, Sci
Los Angeles County Museum, Los Angeles, Sci Series: Zoology
Los Angeles County Museum, Los Angeles, Tech Rep
Los Angeles Herald Examiner
Los Angeles Times
Louisianna, State Univ and Agric and Mech College, Coastal Studies Inst, Bull, Baton Rouge
Louisianna, State Univ and Agric and Mech College, Coastal Studies Inst, Tech Rep, Baton Rouge
Louisianna, State Univ and Agric and Mech College, Water Resourc Res Inst, Bull, Baton Rouge

Louisianna, State Univ and Agric and Mech College, Water Resourc Res Inst, Tech Rep, Baton Rouge
Louisianna Academy of Sci, Proc
Louisianna Polytechnic Inst, Dept of Agric Engr, Rep, Boston
Lysekil, Sweden, Havsfiskelaboratoriet, Meddelande

MHSB, (Maryland H rpetological Soc), Baltimore
MITRE Corp, Paper, Franklin Park, Ill
MacDonald J
Machine Design, Cleveland, Ohio
Maine Law Review
Malacologia, (Inst of Malacology), Ann Arbor, Mich
Malacological Review, Whitmore Lake, Mich
Malacological Soc of London, Proc
Mammalia, (Laboratoire de Zoologte des Mammiferes, Museum D'Histoire Naturelle), Paris
Manitoba, Univ, Agassiz Centr for Water Studies, Res Rep, Winnipeg
Manitoba Law School, Winnipeg, Manitoba, J
Marine Biology, (Springer Verlag), Berlin
Marine Engr and Naval Architect, London
Marine Engr/Log, NY
Marine Geology, Amsterdam
Marine Geophysical Res, (Intl J for the Study of the Earth Beneath the Sea), Dordrecht, Holland
Marine Newsletter, (Coastal Plains Centr for Marine Develop Serv), Wash DC
Marine Observer, (Gr. Britain Meteorological Office), London
Marine Pollut Bull
Marine Tech, (Soc of Naval Architects and Marine Engr), NY
Marine Tech Soc, J
Mariners Weather Log, (U.S. Weather Bureau), Wash DC
Maritime Sediments, (Dalhousie Univ, Inst of Oceanography), Halifax
Maritimes, (Rhode Island, Univ, Grad School of Oceanography), Kingston RI
Martex Mariner, (Mariek Instruments, Inc), Newport Beach, Calif
Maryland, Univ, Water Resourc Res Centr, Completion Rep, College Park
Mass, Univ, Dept of Geology, Coastal Res Group, Tech Rep, Amherst
Mass, Univ, Sch of Engr, Thesis Rep, Amherst
Mass, Univ, Tech Guidance Centr for Ind Environ Control, TGG Bull, Amherst
Mass, Univ, Water Resourc Res Centr, Interim Rep, Amherst
Mass, Univ, Water Resourc Res Centr, Publ, Amherst
Mass Inst of Tech, Charles Stark Draper Lab, Rep, Cambridge
Mass Inst of Tech, Dept of Civ Engr, Water Resourc and Hydrodynamics Lab, Rep, Cambridge
Mass Inst of Tech, Dept of Meteorology, Progress Rep, Cambridge
Mass Inst of TEch, Dept of Naval Architecture and Marine Engr, Master's Thisis, Cambridge
Mass Inst of Tech, Fluid Mech Lab, Publ, Cambridge
Mass Inst of Tech, Lincoln Lab, Tech Note, Lexington
Mass Inst of Tech, Sea Grant Proj Office, Rep, Cambridge
Materials Engr, (Reinhold Publ Corp), NY
Materials Protection and Performance (Natl Assoc of Corrosion Engr), Tex

Materials Res and Standards, (Amer Soc for Testing and Materials), Philadelphia, Pa
Mc Donnel Douglas Corp, Douglas Aircr Co, Final Tech Rep, Long Beach, Calif
McGill Univ, Montreal, Mac Donald Physics Lab, Ice Res Proj, Rep
McGill Univ, Montreal, Marine Sci Centr, Rep, (Annu)
McGill Univ, Montreal, Marine Sci Centr, Manuscr Rep
McGraw-Hill Tech Education News
Metals Engr Quarterly, Amer Soc Metals), Novelty, Ohio
"Meteor" Forschungsergenbisse, Reime A: Allyemeines Physik und Chemie des Meeres, (Deutscher Forshungsgemeinschaft), Berlin
"Meteor" Forschungserbebnisse, Reihe B: Meteorologie und Aeronomie, (Deutscher Forschungsemeinschaft), Berlin
Meteorologocal Soc of Japan, J
Meteorologiia I Giorologiia, Moscow
Mexico (City) Univ Nactional, Inst de Biologia, Anales
Miami, Univ of, Coral Gables, Fla, Inst of Marine Sci, Final Rep
Miami, Univ of, Fla, Dorothy H. and Lewis Rosenstiel Sch of Marine and Atmospheric Sci, Annu Rep
Miami, Univ of, Fla, Dorothy H. and Lewis Rosenstiel Sch of Marine and Atmospheric Sci, News Release
Miami, Univ of Fla, Dorothy H. and Lewis Rosenstiel Sch of Marine and Atmospheric Sci, Tech Rep
Miami, Univ of, Fla, Sea Grant Program, Tech Bull
Miami News
Mich, State Univ, E Lansing, Agric Experiment Station, Res Rep
Mich, State Univ, E Lansing, College of Engr, Div of Engr Res, Completion Rep
Mich, Univ, College of Engr, Dept of Meteorology and Oceanography, Final Rep, Ann Arbor
Mich, Univ, College of Engr, Dept of Naval Architecture and Marine Engr, Tech Rep, Ann Arbor
Mich, Univ, Sch of Public Health, Rep, Ann Arbor
Mich, Water Resourc Comm, Memo, Lansing
Mich, Water Resourc Comm, News Bull, Lansing
Mich, Water Resourc Comm, Water and Related Resourc Data, Lansing
Mich Conservation
Mich Law Review
Microbio, (Amer Inst of Biological Sci), Wash DC
Midwest Res Inst, Kansas City, Mo, Reprint
Misronesica, (College of Guam), Agana
Micropaleotology, (Amer Museum of Natural History), NY
Midwest Res Inst, Newsletter, Kansas City
Midwest Res Inst, Quarterly, Kansas City
Military Engr, J of the Soc of Amer Military Engr, Wash DC
Millipore Corp, News Release, Bedgord, Mass
Mined-Land Conservation
Mines Magazine, (Colorado Sch of Mines), Golden, Colo
Mining Engr, (Amer Inst of Mining and Metall Engr), NY
Mining Equip Mews, Knoxville, Tenn
Minn, Univ Agruc Experiment Station, Tech Bull

Minn, Univ, St Anthony Falls Hydraulic Lab, Proj Rep
Minn, Univ, Water Resourc Res Centr, Bull, Minneapolis
Minn Law Review
Minn Mining and Manuf Co, Space and Defense Products, Quarterly Rep, St Paul
Minnesota Sci
Mississippi, State Univ, Water Resourc Res Inst, Rep, State College
Mississippi Law J
Mitsubishi Jukogyo Kabushiki Kaisha, Mitsubishi Tech Bull, Tokyo
Mitsubishi Nippon Heavy-Industries, Tech Review, Tokyo
Monsanto Co, Monsanto Res Corp, Final Rep, Cincinnati, Ohio
Montana Law Review
Monthly Weather Review, (U.S. Weather Bureau), Wash DC
Mosquito News
Motor Industry Res Assoc, Rep, Warwickshire
Municipal Attorney, (Natl Inst of Municipal Law Officers), Wash DC
Mycologia, (Mycological Soc of Amer), NY

NOAA, (U.S. Natl Oceanic and Atmospheric Admin), Wash DC
Naples, Stazione Zoologica, Pubblicazioni
Natal, Town and REgional Planning Comm, Rep, Pietermitzburg
The Nation
Natl Academy of Sci, Comm on Oceanography Nasco Notes
Natl Academy of Sci -- Natl Res Council, Natl Academy of Engr, Natl Co-operative Highway Res Program, Rep, Wash DC
Natl Academy of Sci -- Natl Res Council, Rep, Wash DC
Natl Asphalt Pavement Assoc, Information Series, Riverdale, MD
Natl Centr for Atmospheric Res, Tech Notes, Boulder, Colo
Natl Fisherman, Camden, ME
Natl Geographic Magazine (Natl Geographic Soc), Wash DC
Natl Observer, (Dow Jones & Co, Inc), NY
Natl Oceanography Assoc, Annu Oceanography Rep, Wash DC
Natl Oceanography Assoc, News Release, Wash DC
Natl Petro Refiners Assoc, Paper, Wash DC
Natl Res Council, Bldg Res Advisory, Fed Construc Council, Tech Rep, Wash DC
Natl Res Council, Div of Engr Comm on Pollut Abatement And Control, Rep, Wash DC
Natl Sci Foundation, Annu Rep, Wash DC
Natl Shell Fisheries Assoc, Proc
Natl Wildlife, (Natl Wildlife Federation), Milwaukee
Natl Wildlife Federation, Conservation Rep, Wash DC
Natural History, (Amer Museum of Natural History), NY
Natural Resourc J, (Univ of New Mexico, Sch of Law) Albuquerque
Natural Resourc Lawyer, (Amer Bar Assoc Sect of Natural Resourc Law, Chgo
Naturalist, Quarterly J, England
Naturaliste Canadien, (Univ Laval), Quebec
Nature, London
Nature in Focus (European Info Centr for Nature Conservation), Strasbourg

Naturwissenschaften, (Max Planck - Gesellschaft zur Forderung der Wissenschaften ...), Berlin-Wilmersdorf, Germany
Nautilus, (Amer Malacological Union), Haverton, Pa
Naval Engr J, Wash DC
Naval Res Reviews, (U.S. Office of Naval Res), Wash DC
Navigation, Revue Technique de Navigation Maritime et Aerienne, (Inst Francais de Navigation), Paris
Navigation, (Inst of Navigation), Wash DC
Navy, (Navy League of the United States), Wash DC
Navy Civ Engr, (U.S. Naval Civ Engr Corps), Wash DC
Nebraska, Univ, Dept of Zoology, Tech Rep, Lincoln
Neotropica, Notas Zoologica Sudamericanas, Buenos Aires
Netherlands J of Sea Res, (Netherlands Inst of Sea Res), Den Helder
New England Interstate Water Pollut Control Comm, Annu Rep, Boston
New England Interstate Water Pollut Control Comm, Guides, Boston
New England Law Review
New England Marine Resourc Infor Program, Pell Marine Sci Library), Narrafansett, RI
New England Water Pollut Control Assoc, J, Hartford, Conn
New England Water Works Assoc, J
Newfoundland, Memorial Univ, St Johns, Library J
New Hampshire, Univ, Water Resourc Res Centr, Completion Rep, Durham
New Hampshire, Univ, Water Resourc Res Centr, Tech Working Paper, Durham
New Hampshire, Univ, Water Resourc Res Centr, Res Rep, Durham
New Jersey, Middlesex County Planning Board Comprehensive Master Plan
New Jersey Environ Times
New Mexico, State Univ of Agric, Engr and Sci, Univ Part, Engr Experiment Station, Tech Rep
New Mexico, Water Quality Board, Summary
New Sci, London
New Sci and Sci J, London
New York, State Univ, Marine Sci Res Centr, Tech Rep Series, Stony Broox
New York, State Univ College, Fredonia, Lake Erie Environ Studies, Public Info Rep
New York, State Univ College, Fredonia, Lake Erie Environ Studies, Tech Data Rep
New York, Univ, Law Review
New York Academy of Sci, Annals, NY
New York Academy of Sci, Transactions, NY
New York Fish and Game J, Albany
New York Ocean Sci Lab, Tech Rep, Montauk
New York State Bar, J
New York (State) College of Forestry, Syracuse, Water Resourc Centr, Rep
New York State Conservation Dept, Div of Conservation Education, Info Leaflet
New York State Conservation Dept, Water Resouc Comm, Rep of Investigation, Albany
New York State Dep of Environ Conservation, News Release, Albany
New York State Dept of Health, Monograph
New York Times
New York Univ, Courant Inst of Math Sci, Rep, NY

New York Univ, Inst of Environ Medicine, Final Progress Rep, NY
New York Univ, Sch of Engr and Sci, Dept of Meteorology and Oceanography, Rep, NY
New York Univ, Sch of Engr and Sci, Res Div, Geophysical Sci Lab, Rep, NY
New York Univ J of Intl Law and Politics (N.Y. Univ Intl Law Soc), NY
New Zealand, Dept of Health, Natl Radiation Lab, Rep, Christchurch
New Zealand, Dept of Sci and Ind Res, Bull, Wellington
New Zealand, Marine Dept, Fisheries Tech Rep, Wellington
New Zealand Engr, (New Zealand Inst of Engr, J)
New Zealand J of Agric Res, (New Zealand, Dept of Sci and Ind Res), Wellington
New Zealand J of Botany, (Dept of Sci and Ind Res), Wellington
New Zealand J of Geology and Geophysics, (Dept of Sci and Ind Res) Wellington
New Zealand J of Marine and Freshwater Res (New Zealand Dept of Sci and Ind Res), Wellington
New Zealand, J of Sci (New Zealand, Dept of Sci and Ind Res), Wellington
Nickel Topics, (Intl Nickel Co, Inc), NY
Norsk Geografisk Tidssdrift, (Norske Geografiske Selskab), Oslo
Norske Videnskaps-Akademi I Oslao, Hvalradets Skrifter
No Atlantic Treaty Organiz, Advisory Group for Aerosp Res and Develop, Advisory Rep, (Paris)
No Carolina, Univ, State College of Agric and Engr, Raleigh, Water Resourc Res Inst, Annu Rep
No Carolina, Univ, State College of Agric and Engr, Raleigh, Water Resourc Res Inst, Rep
No Dakota, Agric Experiment Station, Fargo, Res Rep
No Dakota, State Univ of Agric and Appl Aci, Fargo, Cooperative Extension Serv, Circular,
No Dakota, State Univ of Agric and Appl Sci, Fargo, Water Resourc Res Inst, Annu Rep
No Dakota, State Univ of Agric and Appl Sci, Fargo, Water Resourc Res Inst, Res Proj Tech Completion Rep
No Dakota Law Review
Norther Res and Engr Corp, Rep, Cambridge, Mass
Northup Corp, Northrup Notronics, Northrop Syst Lab, Rep, Palos Verdes Peninsula, Calif
Notre Dame, Ind, Univ, College of Engr, Proj Thesis, Tech Rep
Nouvelle Revue Francaise D'Hematologia, Paris
Nouvi Annali D'Igiene & Microbiologia, Rome
Nova Scotia Bird Soc, Newsletter
Nuclear News, (Amer Nuclear Soc), Chicago
Nucleus, (Parksitan Atomic Energy Comm), Lahore
Nytt Magasin for Botanikk, Oslo
Nytt Magasin for Zoologi, Oslo

Oberflaeche-Surface
OECD Observer (Ograniz for Economic Cooperation and Develop), Paris
Ocean Engr, (Pergamon Press), Long Island City, NY
Ocean Ind, (Gulf Publ Co), Houston, Tex

Ocean Product News, (Chandler Publ, Inc), Chicago
Ocian Sci News, Wash DC
Oceanographical Soc of Japan, J
Oceanology, Wash DC, Translation of the Russion J Okeanologiia
Oceanology Intl, Beverly Shores, Ind
Oceans, Marseille
Oceans Magazine
Oceanus, (Woods Hole, Mass, Oceanographic Inst)
Official Gazette, U.S. Patent Office, Wash DC
Offshore, (Intl Trade Publ), Conroe, Tex
Offshore Tech, London
Ohio, Dept of Health, Water Pollut Control Board, Annu Rep, Columbus
Ohio, State Univ, Columbus, Res Foundation, Inst of Polar Studies, Rep
Ohio State Law J
Oil and Gas J, Tulsa, Okla
Okayama Daigaku, Tamanu Rinkai Jikkensho, Okayama Daigaku Tamano Rinkai Jikkensho Gyoeski, Contributions for the Tamano Marine Lab, Okayama
Okla, State Univ of Agric and Appl Sci, Stillwater, Centr for Water Res in Engr, Publ
Okla, State Univ of Agric and Appl Sci, Stillwater, Okla Water Resourc Res Inst, Proj Completion Rep
Okla, State Univ of Agric and Appl Sci, Stillwater, Okla Water Resourc Res Station Rep
Okla Law Review
Okla Water Resourc Res Inst, Stillwater, Tech Rep
102 Monitor, (Council on Environ Quality), Wash DC
Ontario, Water Resourc Comm, Div of Res, Paper, Canada
Ontario, Water Resourc Comm, Res Publ, Canada
Ophelia, (Copenhagen, Univ, Marine Biological Lab), Helsingoer, Denmark
Optical Spectra, (Optical Publ Co), Pittsfield, Mass
Ordnance, (Amer Ordnance Assoc), Wash DC
Oregon, Fish Comm, Res Rep, Portland
Oregon, State Board of Health, Oregon Health Bull
Oregon, State Dept of Environ Quality, Air Quality Control Div, Annu Rep, Portland
Oregon State Univ, Corvallis, Dept of Oceanography, Data Rep
Oregon State Univ, Corvallis, Sch of Sci, Dept of Oceanography, Prepr
Oregon State Univ, Corvallis, Sch of Sci, Dept of Oceanography, Progress Rep, Res Activities
Oregon, Stare Univ, Corvallis, Sch of Sci, Dept of Oceanography, Tech Rep
Oregon, Univ, Law Review
Ottawa, Dominion Observatory, Gravity Map Series
Our Su, (Sun Oil Co)

Pacific Law J
Pacific NW Sea, Seattle, Wash
Pacific Sci, Honolulu, Hawaii
Palaeogeography, Palaeoclimatology, Palaeoecology, (An Intl J for the Geo-Sci), Amsterdam
Papers in Meteorology and Geophysics, (Meteorological Res Inst), Tokyo
Parisitology, NY

Paris, Museum Natl D'Histoire Naturelle, Bull
Parke Math Lab, Inc, Sci Rep, Carlisle, Mass
Pediatric News
Pedeatric Digest, (Medical Digest, Inc), Winetka, Ill
Penn, Dept of Health Bureao of Housing and Environ Control, Solid Waste Sect, Publ
Penn, State Univ, Inst for Res on Land and Water Resourc, Res Publ
Penn, Univ, Sch of Civ and Mech Engr, Rep, Philadelphia
Penn, Univ, Univ Museum, Final Rep, Philadelphia
Penn Academy of Sci, Proc
Pergamon Progress Series, NY
Pesticides Monitoring J, (U.S. Public Health Serv, Pesticides Program), Atlanta
Petro Engr, Dallas, Tex
Petro Review, (Inst of Petro), London
Petro Today, (Amer Petro Inst), NY
Pharmacometrics
Philadelphia Inquirer
Phillippine J of Sci, Manila
Pilips Tech Review, Eindhoven, Netherlands
Phoenix Gazette
Phoenix Quarterly, (Inst of Scrap Iron and Steel, Inc)
Photogrammetric Engr, (Amer Soc of Photogrammetry), Wash DC
Photography, (Foundain Press Ltd), London
Phycologia, (Intl Phycological Soc), Leyden, Netherlands
Phykos, (Phycological Soc of India), New Delhi
Physiologia Plantarum, Copenhagen
Physiological Zoology, Chicago
Physis, (Sociedad Argentina de Ciencias Naturales), Buenos Aires
Phytopathologische Zeitschrift, Berlin
Phytopathology
La Pisciculture Francaise D'Eau Vive et D'Etang
The Plain Dealer, Cleveland, Ohio
Plant Disease Reporter, Wash
Plastic Rep, (U.S. Plastics Tech Evaluation Centr, Dover, NJ)
Plastics and Polymers, (Plastics Inst), London
Plowshare Civ, Ind and Sci Uses for Nuclear Explosives, Proj Cabriolet, Rep
Polar Record, (Scott Polar Res Inst), Cambridge
Pollut Abstr, La Jolla, Calif
Pollut Atmospherique, (Assoc pour la Prevention de la Pollut Atmosherique), Paris
Pollut Engr
Pollut Equip News, Waseca, Minn
Poultry Sci, (Poultry Sci Assoc)
Power, Chicago
Power Engr, Barrington, Ill
Prace, Morskiego Instytutu Rybackiego: Seria A, Oceanografia I Biologia Rybacka, Goansk, Poland
Problems of Ichthyology, (Amer Fisheries Soc), Wash DC
Process Biochem, (Grampian Press), London

Product Engr, NY
Professional Engr, (Natl Soc of Professional Engr,), Wash DC
Professional Sanitation Mgt, (Inst of Sanitation Mgt), Clearwater, Fla
Progress, (Combustion Engr, Inc), NY
Progressive Fish-Culturist, (U.S. Fish and Wildlife Serv), Wash DC
Public Cleansing, (Inst of Public Cleansing), London
Public Health Rep, (U.S. Public Health Serv), Wash
Public Power, (Amer Public Power Assoc), Wash DC
Puerto Rico, Univ, Dept of Marine Sci, Mayagues, Contrigutions
Pulp and Paper Intl, San Francisco
Purdue Univ, Lafayette, Inc, Engr Bull
Purdue Univ, Lafayette, Ind, Engr Extension Dept Engr Extension Series
Purdue Univ, Lafayette, Inc, Environ Health Inst, Communique
Purdue Univ, Lafayette, Ind, Water Resourc Res Centr, Tech Rep
Purdue Univ, Lafayette, Ind, Event
Pure and Appl Geophysics, Milan
Pure Power, (Amer Public Power Assoc), Wash DC
Pure Water, (City of Chicago, Dept of Water and Sewers, Bureau of Water)

Quebec (Province) Dept of Trade and Commerce, Travaux Sur Les Pecheries du Quebec
Quest, (Wash State Univ, College of Engr), Pullman

Radar and Electronics (Radar & Electronics Assoc), London
Radiation Botany, (Pergamon Press), NY
Radiation Res, (Radiation Res Soc), NY
Ralph M. Parsons Co, Final Rep, Los Angeles, Calif
Rand Corp, Library Literature Series, Santa Monica, Calif
Rand Corp, Memo, Santa Monica, Calif
Rand Corp, Rep, Santa Monica, Calif
Rand Corp, Publ, Santa Monica, Calif
Readers Digest, Pleasantville, NY
Rechereche Agronomique en Suisse
Remote Sensing of the Environ, (Amer Elseview Publ Co), NY
Rennes, Univ, Faculte des Sci, Serie C: These, Paris
Res Inst for Public Health Engr TNO, Annu Rep, Delft, Netherlands
Res Triangle Inst, Final Rep, N Carolina
Residue Review: Residues of Pesticides and Other Foreign Chem in Foods and Feeds, (Academic Press), NY
Respiration Physiology, (Royal Netherlands Academy of Sci), Amsterdam
Reviews of Geophysics, (Amer Geophysical Union), Richmond, Va
Revista de Biologia, Revista Brasileira e Portuguesa de Biologia em Geral, Lisbon
Revue de Geographi Physique et de Geologie Dynamique, Paris
Revue Intl 'Oceanographi Medicale, (Centre D'Etudes et de Recherches de Biologie et D'Oceanographie Medicale), Supplement, Nice
Revue de Physiologie Subaquatique et Medecine Hyperbare, Review of Subaquatic Physiology and Hyper baric Medicine, (Societe Intl D'Edition Medicale) Paris
Revue Roumaine de Biologie, Serie de Zoologie, (Akademia Republicii Pupulare Romine), Bucharest

Rhode Island, State House, News Release, Providence
Rhode Island, Univ, Dept of Ocean Engr, Sea Grant Publ, Rep
Rhode Island, Univ, Law of the Sea Inst, Occasional Paper, Kingston
Rhode Island, Univ, Law of the Sea Inst, Spec Publ, Kingston
Rhode Island, Univ, Narragansett Marine Lab, Occasional Publ, K-ngston
Richmond, Univ, Law Review
Rio de Janeiro, Inst de Pesquisas da Marinha, Publ
Rivista Italiana D;Igiene, *Univ di Pisa, Inst D'Igiene), Italy
Rivista Italiana di Piscicoltura E Ittiopatologia, (Assoc Piscicoltori Italiana), Padua
Rocky Mt Mineral Law Inst, Law J
Royal Inst of Navel Architects, Quarterly Transactions, London
Royal Meteopoligical Soc, Quarterly J, London
Royal Microsopical Soc, J, London
Royal Soc of London, Philosophical Transactions, Series A: Math and Physical Sci, London
Royal Soc of London, Philosophical Transactions Series B: Biological Sci, London
Rule
Rutgers Law Review
Rutgers Univ, New Brunswick, N.J. Water Resourc Res Inst, Annu Rep

S.A. Mining and Engr J, Johannesburg
San Diego County Unified Div Def and Disaster Organiz, Info Bull, Santee, Calif
San Diego Soc of Natural History, Transactions, San Diego, Calif
San Diego Union, Calif
San Francisco, Univ, Law Review
San Francisco Bay Naval Shipyard, Paint Lab, Rep, Vallejo, Calif
San Francisco Chronicle
San Francisco Examiner
Sandia Corp, Albuquerque, N.M., Sandia Labs, Res Rep
Santa Clara Lawyer, (Santa Clara, Calif, Univ, Sch of Law)
Santiago de Chile, Inst de Fomento Pesquero, Bull Cientifico
Santiago de Chile, Inst de Fomento Pesquero, Circular
Sarsia, Bergen, Norway
Saturday Review, NY
Schiffstechnik, Forschungsheft fuer Schiffbau und Schiffsmaschinebau, Hamburg
Schriftenreihe des Vepeins fuer Wasser- Boden- und Lufthygiene, Berlin-Dahlem, Stuttgart
Die Schweizer Gemeinde
Schweizerische Zeitschift fuer Hydroologie
Sci, (Amer Assoc for the Advancement of Sci), Wash DC
Sci Affairs, &Youth Serv Foundation), Ottawa
Sci and Tech, NY
Sci J, London
Sci News, Wash Dc
Sci Teacher, (J of the Natl Sci Teachers Assoc), Wash DC
Sci Amer, NY
Sci and Citizen, (Greater St Louis Citizens Comm for Nuclear Info) St Louis

Scotland, Dept of Agric and Fisheries, Marine Res, Edinburgh
Scotland, Dept of Agric and Fisheries, Marine Lab, Translation, Aberdeen
Scott Res Lab, Inc, Final Rep, Perkansie, Pa
Sea Frontiers, (Intl Oceanographic Foundation), Miami, Fla
Sea Harvest and Ocean Sci, (Natl Business Publ), Gardenvale, Quebec
Sea Secrets, (Intl Oceanographic Foundation, Univ of Miami, Marine Lab), Coral Gables, Fla
Seahorse, (Dillingham Corp, Hydro Products Div), San Diego, Calif
Seascope, (U.S. Naval Undersea Res and Develop Centr), San Diego, Calif
Seattle Post-Intelligencer
Sedimentology, Amsterdam
Seismological Soc of Amer, Bull, Baltimore, Md
Senckenbergiana Maritima, Frankfurt
Seto Marine Biological Lab, Pulb, (Kyoto Univ), Kyoto, Japan
Ship and Boat Intl
Shore and Beach, (Amer Shore and Beach Preservation Assoc), Wash DC
Soc for Experimental Biology and Medicine, Proc
Soc of Naval Architects and Marine Engr, NY, Tech and Res Bull
Soc of Naval Architects and Marine Engr, NY, Tech and Res Rep
Soc of Naval Architects and Marine Engr, NY, Transactions
Soc of Photo-Optical Instrumentation Engr, J, Redondo Beach, Calif
Sogreah Info, (Soc Grenobloise D'Etudes et D'Applications Hydrauliques), France
Soil Conservation
Sound and Vibr, Bay Village, Ohio
So Africa, Div of Sea Fisheries, Fisheries Bull, Pretoria
So Africa, Div of Sea Fisheries, Investigational Rep, Prestoria
So Africa Inst of Mining and Metall, J, Johannesburg
So African J of Sci, (S African Assoc for the Advance of Sci), Johannesburg
So Carolina Law Review
So Dakota, Univ, Completion Rep, Vermillion
So Texas Law J
Southamption, Engr Univ, Inst of Sound and Vibr Res, Memo
So Calif Academy of Sci, Bull, (Los Angeles County Museum), Los Angeles
SW Res Inst, San Antonio, Final Rep
Soviet Geography, Review and Translation, (Amer Geographical Soc of NY),
Soviet Physics, Acoustics, (Amer Inst of Physics) NY
Sperry Rand Engr Review (Sperry Rand Corp), Great Neck, NY
Sperry Rand Res Centr, Final Rep, Sudbury, Mass
Spie - Glass
Sport Fishing Inst, Bull
St Louis Post Dispatch
Standard Oil Co of Calif, Bull
Stanford J of Intl Studies, Stanford, Calif
Stanford Law Review
Stanford Res Inst, Final Rep, Menlo Park, Calif
Stanford Res Inst, Poulter Lab, Tech Rep, Menlo Park, Calif
Stanford Res Inst, Rep, Menlo Park, Calif
Staub-Reinhaltung der Luft, Dusseldorf
Stevens Inst of Tech, Hoboken, NJ, Davidson Lab, Rep
Stevens Inst of Tech, Hoboken, NJ, Ocean Engr Dept, Rep

Stichting Concawe, Document, The Hague
Stichting Concawe, Rep, The Hague
Sulphur, (British Sulphur Corp), London
Suomen Limnologinen Yhdistys Limnologiska Foreninger I Finland
Signal, (Armed Forces Communications Assoc), Wash
Skin Diver, Lynwood, Calif
Smithsonian, Wash DC
Smithsonian Inst, Smithsonian Contributions to Zoology, Wash DC
Smithsonian Inst, Final Rep, Wash DC
Societa Adnatica di Scienze, Bull, Trieste
Soc for Experimental Stress Analysis, Appl Paper, Westport, Conn
Soc of Automotive Engr, Inc, Paper, NY
Soc of Automotive Engr, Inc, Tech Rep, NY
Soil Sci Soc of Amer, Proc
So African Council for Sci and Ind Res, Annu Rep, Pretoria
SW Naturalist, Austin Tex
Soviet Life, Wash DC
Surveying and Mapping, (Amer Congress on Surveying and Mapping), Wash DC
Surveyor, (Amer Bureau of Shipping), NY
Sweden, Foersvarets Forskningsanstalt, Avdelning 3, FOA 3 Rapport, Stockholm
Sweden, Foersvarets Forskiningsanstalt, FOA Reports, Stockholm
Sweden, Statens Naturvardsverk, Publ, Stockholm
Sweden Now, Stockholm
Swedish Natural Sci Res Council, Ecological Res Comm, Bull, Stockholm
Sybron Corp, Aerochem Res Lab, Final Report, Princeton, NJ
Syracuse Lay Review
Syracuse Univ, Res Inst, Status Rep, NY
Syracuse Univ, Res Inst, Tech Rep, NY
Systematic Zoology, (Soc of Syst Zoology), Baltimore, Md

Tane, (Auckland Univ College Field Club), Auckland, New Zealand
Tanker and Bulk Carrier, (Terminus Publ), London
Techniques du Petrole
Tech Ireland, (Inst for Ind Res and Standards, Tech Info Div), Dublin
Tech Review, (Mass Inst of Tech), Boston
Tectonophysics, Amsterdam
Tellus, Stockholm
Tenn Academy of Sci, J
Tetra Tech, Inc, Final Rep, Pasadena, Calif
Tetrahedron: The Intl J of Organic Chem), London
Texas Univ, Centr for Res in Water Resourc, Tech Rep, Austin
Texas Univ, Environ Health Engr Res Lab, Tech Rep
Texas, Univ, Hydraulic Engr Lab, Tech Rep, Austin
Texas, Univ, Marine Sci Inst, Contributions to Marine Sci
Texas, Water Comm, Bull, Austin
Texas, Water Develop Board, Info for News Media, Austin
Texas, Water Develop Board, Rep, Austin
Texas A&M Univ, Sea Grant Program, Sea Grant Publ, College Station
Texas Instruments, Inc, Sci Serv Div, Spec Rep, Dallas
Texas Intl Law Forum, (Univ of Texas Intl Law Soc, Univ of Texas Sch of Law), Austin

Texas J of Sci, (Texas Academy of Sci), Austin
Texas Law Review, (Texas Univ, Sch of Law; Texas Bar Assoc), Austin
Textron, Inc, Dalmo Victor Co, Final Rep, Belmont, Calif
Thailand, Dept of Fisheries, Contrib, Bangkok
Time, the Weekly Newsmagazine, NY
Times-Picayune, New Orleans
Tissue and Cell, London
TNO-Niuws, (Toegepast Natuurwetenschappelijk Onderzdek), Delt, Netherlands
Today's Health
Tohoku J of Agric Res, (Faculty of Agric, Tohoku Univ), Sendai, Japan
Tokai Regional Fisheries Res Lab, Bull
Tokyo, Inst of Public Health, Bull, Japan
Tokyo, Univ, Faculty of Sci, J
Tokyo, Univ of Fisheries, J
Toronto, Univ, Inst for Aerosp Studies, Utias Tech Note
Toronto, Univ, Sch of Law, Law J
Toxicology and Appl Pharmacology, NY
Toxicon, NY
Tracer-Lab/West, Quarterly Rep, Richmond, Calif
Trade Winds, (General Elect Co), NY
Transp Noise Bull, (Natl Academy of Sci, Hwy Res Board, Transp Noise Res Info Serv), Wash DC
Travelers Res Corp, Rep, Hartford, Conn
Trout, (Trout Unlimited), State College
TRW Syst, TRW Syst Group, Rep, Redondo Beach, Calif
Tuatara, (Biological Soc, Victoria Univ), Wellington, New Zealand
Tulsa Law J
Tunisia, Inst Natl Sci et Technique D'Oceanographite et de Peche, Bull, Salambo

UMKC Law Review
UMI To Sora (Marine Meteorological Soc), Kobe, Japan
Undercurrents, (Undercurrents, Inc), New Orleans
Undersea Tech, Wash DC
Undersea Tech; Handbook, Directory, (Compass Publ, Inc), Arlington, Va
Underseas Cable World, (U.S. Underseas Cable Corp), Wash DC
Underwater Letter, (Callahan Publ), Wash DC
Underwater Naturalist, (Amer Littoral Soc), Highlands, NJ
Underwater Sci and Tech J, (Iliff-Nip Inc), NY; Guilford, England
Union Carbide Corp, Nuclear Div, Computing Tech Centr, Rep, Oak Ridge, Tenn
Union College, Mech Engr Dept, Water Resourc Res Group, Rep, Schenectady, NY
Union College Synp, (Union Univ, Schenectady, NY)
United Kingdom Atomic Energy Authority, Ind Group, Health and Safety Branch, AHSB Rep, Risley, England
U.S. Air Force, Cambridge Res Lab, Office of Aerosp Res, Sci Rep, Bedford, Mass
U.S. Air Force, Sch of Aerosp Medicine, Review, Brooks AFB, Texas
U.S. Air Force Syst Command, Foreign Tech Div, Ed Marine Translation, Wright-Patterson AFB, Ohio

U.S. Air Force Syst Command, Foreign Tech Div, Translation, Wright-Patterson AFB, Ohio
U.S. Armed Forces Radiobiology Res Inst, Sci Rep, Bethesda, Dd
U.S. Army Aberdeen Res and Develop Centr, Ballistic Res Lab, Memo Rep, Aberdeen Proving Grounds, Md
U.S. Army Aberdeen Res and Develop Centr, Ballistic Res Lab, Rep, Aberdeen Proving Grounds, Md
U.S. Army Cold Regions Res and Engr Lab, Monograph, Hanover, NH
U.S. Army Cold Regions Res and Engr Lab, Res Rep, Hanover, NH
U.S. Army Cold Regions Res and Engr Lab, Tech Rep, Hanover, NH
U.S. Army Cold Regions Res and Engr Lab, Res Rep, Wilmette, Ill
U.S. Army Engr Reactors Group, Engr Div, Final Rep, Fort Belvoir, Va
U.S. Army Engr Waterways Experiment Station, Contract Rep, Vickburg, Miss
U.S. Army Engr Waterways Experiment Station, Misc Paper, Vicksburg, Miss
U.S. Army Envirn Hygiene Agency, Air Pollut Engr Study, Edgewood Arsenal, Md
U.S. Army Foreign Sci and Tech Centr, Translation, Wash DC
U.S. Army Medical Res Lab, Fort Knox, Ky, Rep
U.S. Army Res Office, Durham, NC, Final Rep
U.S. Army Res Office, Durham, NC, Rep
U.S. Atomic Energy Comm, Health and Safety Lab, Quarterly Summary Rep, NY
U.S. Atomic Energy Comm, Div of Tech Info, Final Rep
U.S. Atomic Energy Comm, Health and Safety Lab, Rep, NY
U.S. Atomic Energy Comm, Oak Ridge Natl Lab, Report, Oak Ridge, Tenn
U.S. Board on Geographical Names, Officiel Name Decision, Gazetteer, Wash DC
U.S. Bureau of Commercial Fisheries, Branch of Current Economic Analysis, Food Fish Situation and Outlook, Wash DC
U.S. Bureau of Commercial Fisheries, Branch of Foreign Fisheries, Translation, Wash DC
U.S. Bureau of Commercial Fisheries, Circular, Wash DC
U.S. Bureau of Commercial Fisheries, Fishery Leaflet, Wash DC
U.S. Bureau of Commercial Fisheries, Fishery Ind Res, Wash DC
U.S. Bureau of Commercial Fisheries, Tropical Atlantic Biological Lab, Cruise Rep, Miami, Fla
U.S. Bureau of Intl Commerce, Publ, Wash DC
U.S. Bureau of Mines, Bull, Wash DC
U.S. Bureau of Mines, Info Circular, Wash DC
U.S. Bureau of Mines, News Release, Wash DC
U.S. Bureau of Mines, Nonmetallic Minerals Program, Tech Progress Rep
U.S. Bureau of Mines, Rep of Investigations, Wash DC
U.S. Bureau of Mines, Solid Waste Program, Tech Progress Rep
U.S. BUreau of Naval Personnel, Naval Personnel Res Activity, Res Memo, Wash DC
U.S. Bureau of Sport Fisheries and Wildlife, Div of Fishery Res, Translation, Wash DC
U.S. Bureau of Sport Fisheries and Wildlife, Res Rep, Wash DC
U.S. Bureau of Sport Fisheries and Wildlife, Resourc Publ, Wash DC
U.S. Bureau of Sport Fisheries and Wildlife, Tech Papers, Wash DC
U.S. Coast Guard, Bull, Wash DC
U.S. Coast Guard, Oceanographic Cruise Announcement, Wash DC

U.S. Coast Guard, Oceanographic Rep, Wash DC
U.S. Coast Guard, Ship Struc Comm, Final Rep
U.S. Coastal Engr Res Centr, CERC Bull and Summary Rep of Res Progress, Wash DC
U.S. Coastal Engr Res Centr, Misc Paper, MP (Wash)
U.S. Coastal Engr Res Centr, Reprint, Wash DC
U.S. Coastal Engr Res Centr, Tech Memo, Wash DC
U.S. Dept of Agric, Agric Handboo, Wash DC
U.S. Dept of Agric, Agric Res Serv, Beltsville, Md, Publ
U.S. Dept of Agric, Forest Serv, Pacific NW Forest and Range Experiment Station, Inst of Northern Forestry, Res Paper, Juneau, Alaska
U.S. Dept of Agric, Forest Serv, Pacific NW Forest and Range Experiment Station, Inst of Northern Forestry, Res Note, Portland, Oregon
U.S. Dept of Agric, Forest Serv, Pacific NW Forest and Range Experiment Station, Res Paper, Portland, Oregon
U.S. Dept of Agric, Forest Serv, Pacific NW Forest and Range Experiment Station, Rep, Portland, Oregon
U.S. Dept of Agric, Forest Serv, Pacific SW Forest and Range Experiment Station, Berkeley, Calif, Res Paper
U.S. Dept of Agric, Misc Publ, Wash DC
U.S. Dept of Commerce, Natl Oceanic and Atomospheric Admin, Sci and Engr News, Wash DC
U.S. Dept of Commerce, News Release, Wash DC
U.S. Dept of Health, Education and Welfare, Food and Drug Admin, Publ, Rockville, Md
U.S. Dept of Health, Education and Welfare, HSMHA Health Rep, Rockville, Md
U.S. Dept of Health, Education and Welfare, News Release
U.S. Dept of the Interior, Conservation Yearbook, Wash, DC
U.S. Dept of the Interior, Dept Library, Bibliography, Wash DC
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Bull of Courses, Cincinnati, Ohio
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Div of Water Quality Res, Analytical Quality Control Lab, FWPCA Method Study, Cincinnati, Ohio
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Middle Atlantic Region, Chesapeake Tech Support Lab, Data Rep
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Middle Atlantic Region, Chesapeake Tech Support Lab, Tech Rep
U.S. Dept of the Interior, Fed Water Pollut Control Admin, NE Region, Res and Develop Program, Edison, NJ
U.S. Dept of the Interior, Fed Water Pollut Control Admin, NW Region, Pacific NW Water Lab, Final Rep, Corvallis, Oregon
U.S. Dept of the Interior, Fed Water Pollut Control Admin, NW Region, Pacific NW Water Lab, Rep, Corvallis, Oregon
U.S. Dept of the Interior, Fed Water Pollut Control Admin, NW Region, Pacific NW Water Lab, Working Paper, Corvallis, Oregon
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Office of Public Info, Publ, Wash DC
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Res Series, Wash DC

U.S. Dept of the Interior, Fed Water Pollut Control Admin, Robt A. Taft Water Res Centr, Rep, Cincinnati, Ohio
U.S. Dept of the Interior, Fed Water Pollut Control Admin, Robt S. Kerr Water Res Center, Rep, Ada, Okla
U.S. Dept of the Interior, Fed Water Quality Admin, NW Region, Pacific NW Water Lab, Working Paper, Corvallis, Orgegon
U.S. Dept of the Interior, Fed Water Quality Admin, Res Series, Wash DC
U.S. Dept of the Interior, News Release, Wash DC
U.S. Dept of the Interior, Water Resourc Sci Info Centr, Bibliography Series
U.S. Dept of the Interior, Water Resourc Sci Info Centr, Selected Water Resourc Abstr
U.S. Environ Protection Agency, Air Pollut Control Offic, Publ, Res Triangle Park, N Carolina
U.S. Environ Protection Agency, Eastern Environ Radiation Lab, Tech Rep, Rockvill, Md
U.S. Environ Protection Agency, Environ News, Wash DC
U.S. Environ Protection Agency, Office of Air Programs, Tech Rep, Res Triangle Park, NC
U.S. Environ Protection Agency, Radiation Office, Radiological Health Data and Rep, Rockville, Md
U.S. Environ Protection Agency, Region X, Tec Rep, Seattle Wash
U.S. Environ Protection Agency, Solid Waste Mgt Office, Rep, Cincinnati
U.S. Environ Protection Agency, Water Quality Office, Tech Rep, Wash DC
U.S. Environ Protection Agency, Water Quality Office, Water Pollut Res Series, Wash DC
U.S. Environ Sci Serv Admin, Air Resourc Atmospheric Turbulence and Diffusion Lab, Rep, Oak Ridge, Tenn
U.S. Environ Sci Serv Admin, Barbados Oceanographic and Meteorological Analysis Proj Office, Bomex Bull, Rockville, Md
U.S. Environ Sci Serv Admin, Environ Data Serv, Tech Memo, Silver Spring, Md
U.S. Environ Sci Serv Admin, Inst for Telecommunication Sci, Res Lab, Tech Memo, Boulder, Colo
U.S. Environ Sci Serv Admin, Pacific Oceanographic Lab, Tech Rep, Miami, Fla
U.S. Environ Sci Serv Admin, Publ, Wash DC
U.S. Environ Sci Serv Admin, Weather Bureau, Sci Serv Div, Western Region, Salt Lake City, Utah, Tech Memo
U.S. Fed Council for Sci and Tech, Interdept Comm for Atmospheric Sci, Rep, Wash DC
U.S. Fed Council for Sci and Tech, Publ, Wash DC
U.S. Fed Maritime Comm, News Release, Wash DC
U.S. Fish and Wildlife Serv, Data Rep, Wash DC
U.S. Fish and Wildlife Serv, Fishery Bull, Wash DC
U.S. Fish and Wildlife Serv, Spec Sci Rep - Fisheries, Wash DC
U.S. Geological Survey, Annu Rep, Menlo Park, Calif
U.S. Geological Survey, Circular, Wash DC
U.S. Geological Survey, Misc Geologic Investigations Map
U.S. Geological Survey, Professional Paper, Wash DC

U.S. Geological Survey, Proj Rep, Wash DC
U.S. Geological Survey, Water Resourc Div, Open File Rep, Menlo Park, Calif
U.S. Joint Publ Res Serv, Tech Translations, Wash DC
U.S. Maritime Admin, Office of ship Construction, Summary Rep
U.S. Natl Aeronau and Space Admin, NASA SP, Wash DC
U.S. Natl Aeronau and Space Admin, Tech Translation, Wash DC
U.S. Natl Aeronau and Space Admin, Tech Utilization Div, Survey
U.S. Natl Bureau of Standards, Spec Publ, Wash DC
U.S. Natl Bureau of Standards, Tech News, Bull, Wash DC
U.S. Natl Museum Bull, Wash DC
U.S. Natl Oceanic and Atmospheric Admin
U.S. Natl Oceanic and Atmospheric Admin, Natl Marine Fisheries Serv, Fishery Bull, Natl Marine Fisheries Serv, Spec Sci Rep - Fisheries
U.S. Natl Oceanographic Data Centr, Newsletter, Wash DC
U.S. Natl Oceanographic Instrumentation Centr, Tech Bull, Wash DC
U.S Naval Civ Engr Lab, Tech Note, Port Hueneme, Calif
U.S. Naval Civ Engr Lab, Tech Rep, Port Hueneme, Calif
U.S. Naval Inst, Proc, Annapolis, Md
U.S. Naval Intelligence Command, Naval Intelligence Command Headquarters, Translation Div, Translation
U.S. Naval Medical Res Inst, Res Rep, Bethesda, Md
U.S. Naval Oceanographic Office, Bull, Suitland, Mc
U.S. Naval Oceanographic Office, Contract Translation, Wash DC
U.S. Naval Oceanographic Office, Informal Rep, Wash DC
U.S. Naval Oceanographic Office, News Release, Wash DC
U.S. Naval Oceanographic Office, Pilot Chart, Wash DC
U.S. Naval Oceanographic Office, Publ, Wash DC
U.S. Naval Oceanographic Office, Spec Publ, Wash DC
U.S. Naval Oceanographic Office, Tech Rep, Wash DC
U.S. Naval Oceanographic Office, Translation, Wash DC
U.S. Naval Ordnance Lab, Tech Rep, White Oak, Md
U.S. Naval Postgrad School, Masters Thesis, Monterey, Calif
U.S. Naval Postgrad School, Tech Rep, Monterey, Calif
U.S. Naval Radiological Defense Lab, Tech Rep, San Francisco, Calif
U.S. Naval Res Lab, Annu Rep, Wash DC
U.S. Naval Res Lab, Memo Rep, Wash DC
U.S. Naval Res Lab, Progress Rep, Wash DC
U.S. Naval Res Lab, Rep, Wash DC
U.S. Naval Res Lab, Translation, Wash DC
U.S. Naval Res Lab, Underwater Sound Ref Div, Rep, Orlando, Fla
U.S. Naval Sci and Intelligence Centr, Tech Rep, Wash DC
U.S. Naval Ship Res and Develop Centr, Acoustics and Vibr Lab, Res and Develop Rep, Wash DC
U.S. Naval Ship Res and Develop Centr, Hydromech Lab, Res and Develop Rep, Wash DC
U.S. Naval Ship Res and Develop Centr, Machinery Lab, Res and Develop Rep, Wash DC
U.S. Naval Ship Res and Develop Centr, Rep, Wash DC
U.S. Naval Ship Res and Develop Centr, Struc Mech Lab, Res and Develp Rep, Wash DC

U.S. Naval Ship Syst Command, Navships Translation, Wash DC
U.S. Naval Ship Syst Command, Publ, Wash DC
U.S. Naval Ship Syst Command, U.S. Navy Supervisor of Diving, Rep, Wash DC
U.S. Naval Submarine Medical Centr, Memo Rep, Submarine Base, Groton, Conn
U.S. Naval Submarine Medical Centr, Rep, Submarine Base, Groton, Conn
U.S. Naval Undersea Res and Dev Centr, Tech Note, San Diego, Calif
U.S. Naval Underseas Warfare Centr, Rep, San Diego, Calif
U.S. Navy Experimental Diving Unit, Res Rep, Wash DC
U.S. Navy Underwater Sound Lab, Rep, New London, Conn
U.S. News and World Rep
U.S. Office of Naval Res, London Branch Office, ONR London Conf Rep
U.S. Office of Naval Res, ONR Rep, Wash DC
U.S. Office of Naval Res, Tech Rep, Wash DC
U.S. Office of Saline Water, Desalting Plants Inventory Rep, Wash DC
U.S. Office of Saline Water, Res and Dev Progress Rep, Wash DC
U.S. Office of the Oceanographer of the Navy, Marine Sci Affairs Staff, Publ, Wash DC
U.S. Office of the Oceanographer of the Navy, Pamphlet, Wash DC
U.S. Pacific Missile Range, Misc Rep, Point Magu, Calif
U.S. Public Health Serv, Bureau of Disease Prevention and Environ Control, Natl Centr for Radiological Health, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, Annu Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, Div of Biological Effects, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, Div of Elect Prod, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, Div of Environ Radiation, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, NE Radiological Health Lab, Tech Rep, Winchester, Mass
U.S. Public Health Serv, Bureau of Radiological Health, Office of Regional Operations, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, Radiological Health Health and Data Rep, Rockville Md
U.S. Public Health Serv, Bureau of Radiological Health, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, Sem Paper, Rockville, Md
U.S. Public Health Serv, Bureau of Radiological Health, SW Radiological Health Lab, Rep, Las Vegas, Nevada
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Interim Rep, Cincinnati, Ohio
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Operation Test Rep, Cincinnati, Ohio
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Publ, Cincinnati, Ohio
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Publ, Rockville, Md
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Rep, Rockville, Md
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Solid Waste Info Retrieval Syst, Accession Bull

U.S. Public Health Serv, Bureau of Solid Waste Mgt, Tech Abstr, Rockville, Md
U.S. Public Health Serv, Bureau of Solid Waste Mgt, Tech Rep, Cincinnati, Ohio
U.S. Public Health Serv, Natl Air Pollut Contr Admin, Publ, Raleigh, NC
U.S. Public Health Serv, Publ, Rockville, Md
U.S. Public Health Serv, Publ, Wash DC
Univerzitet U Bedgradu, Radova Pooprivreonog Fakulteta, Zbornik, Yugoslavia
Urgan Georgia
Urban Inst, Paper, Wash DC
URS Res Co, Final Rep, Burlingame, Calif
URS Res Co, Rep, Burlingame, Calif
Utah State Dept of Fish and Game Publ
Utah, State Univ, Water Res Lab, Occasional Paper, Logan

Vaextskydosnotiser, Solna, Sweden
Valparaiso Univ, Law Review
Vatten, Tidskrift for Vattenvard, Lund
Veliger, (Northern Calif Malacological Club), Berkeley, Calif
Venus, (Malagological Soc of Japan), Tokyo
Vie et Milieu, Serie A: Biologie Marine, (Paris, Univ, Lab Arago)
Vie et Milieu, Serie B: Oceanographi, (Paris, Univ, Lab Arago)
Villanova Law Review, Villanova, P
Virginia Forward, (Virginia, Div of Ind Dev and Planning), Richmond
Virginia Inst of Marine Sci, Marine Resourc Advisory Series, Gloucester Pt
Virginia Inst of Marine Sci, Gloucester Pt, News Release
Virginia Inst of Marine Sci, Gloucester Pt, Bull
Virginia Inst of Marine Sci, Gloucester Pt, Spec Rep
Virginia J of Intl Law, (Virginia, Univ, John Bassett Moore Soc of Intl Law), Charlottesville, Va
Virginia Law Review
Virginia Polytech Inst, Blacksburg, Water Resourc Res Centr, Bull
Vitro Corp of Amer, Vitro Lab, Tech Note, Silver Spring, Md
Voprosy Ikhtiologii, (Akademiia Nauk SSSR, Ikhtiologicheskaia Komissiia), Moscow

Wake Forest Law Review
Wall Street J, NY
Washburn Law J
Wash Academy of Sci, Wash DC
Wash Post, Wash DC
Wash (State) State Univ, Pullman, Agric Experiment Station, Circular
Wash (State) State Univ, Pullman, College of Engr, Res Div, Bull
Wash (State) State Univ, Pullman, College of Engr, Res Div, Rep
Wash (State) State Univ, Pullman, Tech Bull, Agric Experiment Station
Wash (State) State Univ, Pullman, Water Res Centr, Final Rep
Wash (State) State Univ, Pullman, Water Res Centr, Rep
Wash (State) State Univ, Pullman, Water Res Centr, Tech Res Proj Completion Rep

Wash (State) Univ, College ofFisheries, Fisheries Res Inst, Circular, Seattle
Wash (State) Univ, College of Forest Resourc, Res and Develop Tech Rep, Seattle
Wash (State) Univ, Dept of Atmospheric Sci, TEch Rep, Seattle
Wash (State) Univ, Div of Marine Resourc, Sea Grant Program, Circular
Wash Sci Trends, Highlights, Wash DC
Wasmann J of Biology, (Univ of San Francisco), Calif
Wasser, Luft und Betried, Mainz
Wasserwirischaft, Berlin, Germany
Waste Age
Waste Trade J, (The Market Autority on Secondary Raw Materials), NY
Water, SW Water Works J
Water and Pollut Control, Ontario
Water and Sewage Works, Chicago
Water and Waste Treatment, Surrey
Water and Wastes Engr, NY
Water for Texas, (Texas Water Develop Board), Austin
Water in the News (Soap and Detergent Assoc), NY
Water J, (Rockwell Manuf Co), Pittsburgh
Water Pollut Control, (Inst of Water Pollut Control, J), London
Water Pollut Control Federation, Deeds and Data, Wash DC
Water Pollut Control Federation, Highlights, Wash DC
Water Pollut Control Federation, J, (Water Pollut Control Federation), Wash, DC
Water Pollut Control Federation, WFCF Publ, Wash DC
Water and Water Engr, (Fuel and Metall J, Ltd), London
Water Pollut Control Assoc of Penn , Magazine, State College
Water Res, (Intl Assoc Water Pollut Res), NY
Water Res Assoc, Tech Paper, Marlow, England
Water Resourc Bull, (Amer Water Resourc Assoc), Urbana, Ill
Water Resourc Res, (Amer Geophysical Union), Wash DC
Water Spectru, (U.S. Army Corps of Engr), Wash DC
Water Treatment and examination
Water Well J, Urbana, Ill
Wayne Law Review
Weather (Royal Meteorological Soc), London
Weatherwise, (Amer Meteorological Soc), Boston
Weed Res, (European Weed Res Council), Oxford, England
Weed Sci, (Weed Sci Soc of Amer), Ithaca, NY; Columbus, Ohio; Urbana, Ill
Weeds, (Weed Soc of Amer), Ithaca, NY
Wellington, New Zealand, Oceanographic Inst, Misc Series
West Virginia Univ, Bull
West Virginia, Univ, Water Res Inst, Bull, Morgantown
West Virginia, Univ, Water Res Inst, Res Rep, Morgantown
Westinghouse Elect Corp, News Release, Pittsburgh
Westinghouse Elect Corp, Res Lab, Final Rep, Pittsburgh
Wetter and Legen, Zeitschift fuer Angewandte Meteorologie, (Oesterreichische Gesellschaft fuer Meteorologie), Vienna
What's New in Home Economics

Wildlife Disease Assoc, Bull, Chicago
William and Mary Law Review, (College of William and Mary), Williamsburg, Va
Wilson Bull
Wisc, Dept of Natural Recourc, Publ, Madison
Wisc, Dept of Natural Resourc, Res Rep, Madison
Wisc, Univ, Dept of Genetics, Tech Progress Rep, Madison
Wisc, Univ, Geophysical and Polar Res Centr, Res Rep Series, Madison
Wisc Univ, Sea Grant Program, Reprint, Madison
Wisc Univ, Sea Grant Program, Tech Rep, Madison
Wisc Univ, Water Resourc Centr, Eutrophication Info Program, Literature Review, Madison
Wisc Univ, Water Resourc Centr, Eutrophication Info Program, Occasional Paper, Madison
Wisc, Univ, Water Resourc Centr, Eutrophication Program, Abstr, Madison
Wisc Univ, Water Resourc Centr, Hydraulics and Sanitation Lab, Tech Completion Rep, Madison
Wisc Conservation Bill
Wisc Law Review
Woods Hole, Mass, Marine Biological Lab, Annu Announcement
Woods Hole Oceanographic Inst, Woods Hole, Mass, Ref
Work Boat, New Orleans
World Data Centr A, Oceanography, Wash DC
World Dredging and Marine Construction, (World Trade Publ Inc), Conroe, Texas
World Econogy 2000, Wash
World Fishing, London
World Health Organiz, Bull, Geneva
World Health Organiz, Chronicle
World Health Organiz, Public Health Papers, Geneva
World Health Organiz, Tech Rep Series, Geneva
World Meteorological Organiz, RP Rep, Geneva
World Meteorological Organiz, Rep, Geneva
World Meteorological Organiz, Tech Note, Geneva
World Meteorological Organiz, World Weather Watch, Planning Rep, Geneva
World Mining, San Francisco, Calif
World Oil, Houston, Tex
World Petro, NY
World Ports, (Amer Assoc of Port Authorities), Wash DC
Wormley, England (Surrey), Natl Inst of Oceanography, Annu Rep
Wyle Lab, Res Div, Huntsville Facility, Res Rep
Wyoming, Univ, College of Law, Land and Water Law Review
Wyoming, Univ, Water Resourc Res Inst, Rep, Laramie

Yale J of Biology and Medicine
Yale Univ, Law J
Yearbook of Agric, Separate

MASTER LIST OF SPECIAL PUBLICATIONS USED BY POLLUTION ABSTRACTS

AIAA, Sixth Annu Meet and Tech Display, Selected Papers, (held in Anaheim, Calif, Oct 20-24, 1969) in: Amer Inst of Aero and Astro, Papers 1101-1102, 1120, 1122, 1136: 38 p, 1969; Price per paper $1.00, $1.50, nonmembers

APRAC Status Rep Coord Res Council, Inc, New York City, 111 p, Jan 1971

The A-8-Seas of Desalting, Booklet, U.S. Dept of the Interior, Office of Saline Water, Wash DC, 43 p, Price: $0.35

Academic Prog 1969-70, Univ of Fla, Dept of Speech, Communication Sci Lab, Gainesville, 37 p, 1969

Accelerated Tests for Marine Topside and Submerged Coatings Symp, Papers, Hamner, Norman E. (ed). (Held in San Fran, Calif, Oct 5-7, 1966). Sponsored by Natl Assoc of Corrosion Engr, Western Region Conf, 108 p, 1969, Price: $12.00, $15.00, nonmembers

Acoust Soc Amer, Annu Meet 81st Sess 8R Engr Acoust IV, Instruments for Air and Water Acoust Measure, Abstracts (held in Wash DC, Apr 23, 1971. In: Acoust Soc Amer J, v 50 n 1, July 1971

Acoust Soc Amer, 78th Meet, Abstracts (held in San Diego, Calf, Nov 4-7, 1969. In: Acoust Soc Amer J, v 47 n 1, Jan 1970, p 54-135

Acoust Soc Amer, 79th Meet, Abstracts (held in San Diego, Calif, Nov 4-7, 1969. In: Acoust Soc Amer J, v 48 n 1, July 1970, p 70-134

Activities of Water Reso Div, Calif Dist in the 1972 Fiscal Year, Rep., U.S. Geol Surv, Water Resources Div, Menlo Park, Calif, 1971, 39 p

Actual Capital and Operating Costs for Advanced Waste Treatment, Paper, Evans, D. R. and Wilson, J. C., 1970, 34 p

The Adoption of Proposed Amendments to the Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina, Public Hearing, Rep of Proc held in Raleigh, NC, June 26, 1970, State of NC, Board of Water and Air Resources, Dept of Water and Air Resources, Raleigh, NC, 1970, 84 p

Advances in Instru, v 26, parts I, II, III, and IV, Instru Soc of Amer, Annu Conf, 26th Proc, held in Chicago, Ill, Oct 4-7, 1971, 1005 p

Advanced Waste Treat and Water Reuse Symp, Sessions I, II, III, IV and V, Papers, held in Dallas, Tex, Jan 12-14, 1971, cosponsored by U.S. Environ Prot Agency, Wash DC, Arkansas Pollut Contr Comm, La Stream Control Comm New Mexico Health and Soc Serv Dept, Oklahoma Pollut Contr Coord Board and Texas Water Quality Board, 1971, 481 p

Advanced Water Conf, Proc, held in Stillwater, Okla, March 30-31, 1970, sponsored by Oklahoma State Univ, Univ Ext, College of Engr, Stillwater, 1970, 114 p

Advances in Instru, v 24, part III, Instru Soc of Amer, 24th Annu Conf, Proc held in Houston, Tex, Oct 27-30, 1969, 241 p

Advances in Water Pollut Res, Intl Conf on Water Pollut Res, 4th Proc-Jenkins, S. H. (ed), held in Prague, Czechoslovakia, April 21-25, 1969, sponsored by Intl Assoc on Water Pollut Res, Pergamon Press, New York, 1969, 936 p. Price: $48.00

Advances in Water Pollut Res, vl, Intl Conf, Proc, Southgate, B. A. (ed), held in London, Eng, Sept 2, 1962, Cosponsored by Centre Belge D-Etude et de Documentation Des Eaux, Belgium; Assn Francaise Pour L'Etude des Eaux, France; Abwassertechnische Vereinigung, Germany; Inst of Sewage Purification, England; Inst of Public Health Engr, England; Rivers Boards

Assn, England; Scottish River Purification Boards Assn, Scotland; Soc Chem Ind, England; Foereninger foer Vattenhygien, Sweden; Water Pollution Cont Federation, US; Amer Chem Soc, US; Amer Inst Chem Engr, US; Intl Org for Economic Cooperation and Development; Intl J Air and Water Pollut and World Health Organ, Geneva. The MacMillan Co, NY, 1964, 378 p

Advances in Water Pollut Res, v II, Intl Conf, Proc, Eckenfelder, W. W. (ed), held in London, Eng, Sept 1962, cosponsored by Centre Eelge D'Etude et de Documentation des Eaux, France: Abwassertechnische Vereinigung, Germany; Inst of Sewage Purification, England; Inst of Public Health Engr, England; Rivers Boards Assn, England; Scottish River Purification Boards Assoc, Scotland; Soc Chem Ind, England; Foereningen fuer Vattenhygien, Sweden; Water Pollut Control Fed, US; Chemical Engr, US; Amer Inst Chem Engr, US; Amer Water Works Assoc, US; Intl Organ for Economic Cooperation and Development; Intl J Air and Water Pollut and World Health Organ, Geneva. The MacMillan Co, NY, 1964, 582 p

Advances in Water Pollut Res, v III, Intl Conf, Proc, Pearson, E. A. (ed), held in London, Eng, Sept 1962, cosponsored by Centre Belge O'Etude et de Documentation des Eaux, Belgium; Assoc Franciase Pour L'Etude des Eaux, France; Abwassertechnische Vereinicung, Germany; Inst of Sewage Purification, England; Inst Public Health Engr, England; Rivers Boards Assoc, England; Scottish River Purification Boards Assoc, Scotland; Soc Chem Indus, England; Foereningen foer Vattenhygien, Sweden; Water Pollut Control Fed, US; Amer Chem Soc, US; Amer Inst of Chem Engr, US; Amer Water Works Assoc, US; Intl Organ for Economic Cooperation and Development; Intl J Air and Water Pollut and World Health Organ, Geneva. The MacMillan Co, New York, 1964, 441 p

Advances in Water Quality Improvement, Symp, Papers, Gloyna, E. F. and Eckenfelder, W. W. Jr, (ed), held in Austin, Tex, April 1966, Sponsored by Univ of Tex Center for Res in Water Resources, Austin Tex, Univ of Tex Press, Austin, 1968, 524 p, Price: $15.00

Aerodynamic Noise, Symp Proc, Ridner, H. S. (ed) held in Toronto, Canada May 20-21, 1968, sponsored by U.S. Air Force Office of Scientific Res U.S. Air Force Office of Aerospace Res and Univ of Toronto, Inst for Aerospace Studies, Canada, Univ of Toronto Press, 1969, 450 p, Price: $15.00

Aerospace and Marine Corrosion Tech Sem, First Joint, Proc, Jacobs, B. L. (ed) held in L.A., Calif, July 10-12, 1968, sponsored by Natl Assoc of Corrosion Engr, Houston Tex, 1968, 130 p, $12.00, $15.00 non-members

Aerophysics of Air Pollut, Selected Papers, Fay, J. A. and Hoult, D. P., (ed) AIAA Selected Reprint Series v 9, New York, N.Y., Dec 1969, 126 p, Price: $2.50

Agriculture and the Quality of Our Environment, Amer Assoc for the Advancement of Science, Meeting, 153rd Symp, Proc, Brady, N. C, (ed) held in Wash DC, Dec 26-31, 1966, sponsored by Amer Soc of Agronomy, Amer Soc of Animal Science; Amer Soc of Plant Physiologists; Entomological Soc of Amer; Poultry Science Assoc, Soc of Amer Foresters and Soil Conservation Soc of Amer, Amer Assoc for the Advancement of Science Pub 85, Wash, DC, 1967, 460 p, Price: $13.50

Agricultural Chemicals--Harmony or Discord Food, People, Environment, Symp, Proc, Swift, J. E., (ed), held in Sacremento, Calif, Feb 16-17, 1971, sponsored by Univ of Calif, Div of Agricultural Science, Berkley, Davis and Riverside, 1971, 151 p

Air and Water Conservation Expenditures of the Petroleum Ind in the U.S. Rep Crossley, 5-0 Surveys Inc NY, NY, Aug 1968, 31 p

Air and Water Depollut: Roles of Ind Property, innovation and competition, Conf, Proc, (Held in Wash DC, Mar 31, 19701, Sponsored by Geo Wash Univ, PTC Res Inst, Wash, DC, 1970, 141 p

Air and Water Pollut Control Act, State of Miss, Air and Water Pollut Control Commission, Jackson, 1968, 15 p

Air and Water Pollut Control Act, State of Miss, Air and Water Pollut Control Commission, Jackson, 1968, 16 p

Air Classification for Reclamation of Solid Wastes, Pap, Boettcher, Richard A, 1969, 12 p

Air Pollut, First European Congress on the Influence of Air Pollut, Workbook, Brodine, Va and Bradford, Albert (eds), Scientists' Inst for Public Info, NY, NY, 1970, 28 p

Air Pollut and the Compression-Ignition Engine, Pap, Hurn, R. W. The Combustion Inst, Pittsburgh, Pa, 1969, 11 p

Air Pollut and the Regulated Electric Power and Natural Gas Ind, Rep Federal Power Comm, Wash, DC, Sept 1968, 384 p

Air Pollut Conf, Second Pap, (Held in Johannesburg, S. Africa, Oct. 14-15, 19701, Sponsored by Council for Scientific and Ind Res, Pretoria, S. Africa and Natl Assoc for Clean Air, S. Africa, 1971, 82 p

Air Pollut Control Assoc, Annual Meeting, 64th Proc, Digest, (Held in Atlantic City, NJ, Jun 27-July 1, 19711, 1971, 166 p

Air Pollut Control in New S. Wales, Pap, Murphy, R. P., 1969, 24 p

Air Pollut Control Regulation and Sampling, Conf, Proc, (Held in State College, Pa, May 26, 19701, Spon by Pa State Univ, Continuing Education Prog, Center for Air Environment Studies, State College, 1970, 46 p

Air Pollut Effects, Criteria, Standards and Air Resource Mgt, Pap, Wunderle, Jack A., 13 p

Air Pollut Emergencies, Causes, Controls and Consequences, Tech Conf, Semi-annual, Proc, (Held in Newark, NJ, 1969, Oct. 17) Sponsored by Air Pollution Control Assoc, Mid-Atlantic States Sect, Pittsburgh, Pa, 1969, 86 p

Air Pollut Engr Manual, Air Pollut Control Dist, County of Los Angeles, Danielson, John A. (ed.) U.S. Public Health Serv, Natl Center for Air Pollut Control, Cincinnati, O, 1967, Price: $.65, 897 p

Air Pollut Engr Manual, Danielson, John A. (Ed.) In: U.S. Public Health Serv, Wash, DC, Publication No, 999-AP-40, 1967, Price: $5.75, 892 p

Air Pollut Experiments for Jr and Sen High School Science Classes, Rep, Hunter, Donald, C. and Wohlers, Henry C. (eds), Air Pollut Control Assoc, Mid Atlantic States Sect, Education Committee, Pittsburgh, Pa, 1968, 64 p

Air Pollut in Allegany County, MY, Report, Alkire, H. L. and York, Carl R. MY State Dept of Health and Mental Hygiene, Div of Air Quality Control, Baltimore, July 1970, 214 p

Air Pollut in Garrett County, MY, Rep, Alkire, H. L. MY State Dept of Health, Div of Air Quality Control, Baltimore, March 1969, 30 p

Air Pollut in the San Francisco Bay Area, Final Rep, Stanford Workshop on Air Pollut, Stanford, Calif, Summer 1970, 386 p

Air Pollut Instrumentation, Symp, Pap, Adams, Donald F. (ed) (Held in Los Angeles, Calif, Oct 1965) Sponsored by the Instrument Soc of Amer, Analysis Instru Div, Air Pollut Instru Comm, Pittsburgh, Pa and Air Pollut Control Assoc, W. Coast Sect, 1966, 79 p

Air Pollut Manual, Pt II - Control Eqpt, Amer Ind Hygiene Assoc, Detroit, Mich, 1968, Price: $15.00, 150 p

Air Pollut Med Res Conf, Unbound pap, (Held in New Orleans, La, Oct 5-7, 1970), Sponsored by Amer Med Assoc, 1970, Air Pollut on Plants and Animals, Proceedings, (Held in Wageningen, Neth., Apr 22-27, 1968). Sponsored by Netherlands Gov and Council of Europe, European Committee for the Conservation of Nature and Natural Resources, Centre for Agricultural Publ and Documentation, Wageningen, 1969, 395 p. Price: DFL 42.50

Air Pollut Meteorology, Conf, Preprints, (Held in Raleigh, NC, Apr 5-9, 1971), Sponsored by Amer Meteorological Soc and Air Pollut Control Assoc, Amer Meteorological Soc, Boston, Mass, 1971, 169 p

Air Pollut Training Courses Jul 1971 through Jun 1972 and Univ Training Programs, Bulletin, U.S. Environmental Protection Agency, Res Triangle Park, N.C. July 1971, 107 p

Air Quality and Lead, Symp, Pap, (Held in Minneapolis, Minn, Apr 14-15, 1969), Sponsored by Amer Chem Soc, Div of Ind and Engr Chemistry, Div of Water, Air and Waste and Div of Petroleum Chemistry, In: Environmental Science and Tech, Apr 1970, 4(4): 305-340

Air Quality Reg, Reg APC-S-1, State of Miss, Air and Water Pollut Control Comm, Jackson, May 8, 1970, 10 p

Air Quality Reg, State of Miss, Air and Water Pollut Control Comm, Jackson, 1970, 9 p

Aircraft Engine Noise and Sonic Boom, Conf Proc, (Held in St Louis, Fr., May 27-30, 1969), Spon by N. Atlantic Treaty Organ

Aircraft Noise: Acoustical Duct Treatments for Aircraft, Acoustical Soc of Amer, 77th Meeting, Symp, Proc, (Held in Philadelphia, Pa, Apr 8, 1969), In: Acoustical Soc of Amer, J, Sept 1970, 48(3): 779-842, Advisory Group for Aerospace Res and Development (AGARD), Paris, Fr., In: NATO Advisory Group for Aerospace Res and Development, Paris, AGARD Conf Proc No. 42, 1969, 565 p. Price: $3.00

ALGAE, Man, and the Environment, Intl Symp, Proc, Jackson, Daniel F., (ed), (Held in Syracuse, NY, June 18-30, 1967), Spon by Syracuse Univ NY and NY State Science and Tech Foundation, Syracuse Univ Press, NY, 1968, 560 p. Price: $18.00

Ambient Air Quality Standards for the Commonwealth of Massachusetts, Commonwealth of Massachusetts, Dept of Public Health, Div of Environmental Health, Bur of Air Use Management, Boston, Apr 14, 1970, 5 p

Amchitka Island Bioenvironmental Studies, Amer Inst of Biological Studies Annual Meeting, 21st Symp, Proc, Duke, James A. (ed), (Held in Bloomington, Ind, Aug 26-27, 1970). In: Biosciaence, Jun 15, 1971, 21(12): 595-711

American Astronautical Soc, Natl Meeting, (Held in Las Cruces, NM, Oct. 23-25, 1969). Unbound Pap 1969

American Astronautical Soc (15th Annual) and Operations Res Soc (35th Natl), Joint Natl Meeting, Selected Preprints, (Held in Denver, Colo, Jun 17-20, 1969), In: Amer Astronautical Society, Preprints Nos. AAS69-062 and AAS69-116, 1969, 38 p

Amer Chem Soc, Div of Organic Coating and Plastics Chemistry, 158th NY Meeting, Pap, (Held in NY, Sept 7-12, 1969), 1969, 563 p.

Amer Chem Soc, Div of Water, Air and Waste Chem, Natl Meeting, 159th Pap, (Held in Houston, Tex, Feb 22-27, 1970), 1970, 143 p.

Amer Chem Soc, Natl Meeting, 15th, Abstracts of Pap, (Held in Minneapolis, Minn, Apr 13-18, 1969), 1969, 574 p, Price: $3.00, $4.00 (non-members).

Amer Chem Soc, Natl Meeting, 161st Abstracts, (Held in Los Angeles, Calif, Mar 28- Apr 2, 1971), 1971, 878 p, Price: $3.00, $4.00 (non-members).

Amer Congress on Surveying and Happing, Annu Meeting, 31st Pap, (Held in Wash DC, Mar 7-12, 1971), 1971, 798 p

Amer Inst of Mining, Metallurgical and Petroleum Eng, Soc of Petroleum Eng, Forty-Fourth Annu Fall Meeting, Selected Preprints, (Held in Denver, Colo, Sept 28 - Oct 1, 1969), In: Amer Inst of Mining, Metallurgical and Petroleum Eng, Soc of Petroleum Eng, Preprints Nos. SPE 2613-SPE 2614, SPE 2635- SPE 2639, 1969, 74 p

Amer Inst of Mining, Metallurgical and Petroleum Eng, Inc. Soc of Petroleum Eng, Inc. Soc of Petroleum Eng, Fall Meeting, 45th Annu Preprints (Held in Houston, Tex Oct 4-7, 1970) In: Amer Inst of Mining, Metallurgical and Petroleum Eng, Soc of Petroleum Eng, Preprints Nos. SPE-2943, SPE-3018, SPE-3019, SPE-3021, SPE-3023, and SPE-3094, 1970, 80 p

Amer Inst of Mining, Metallurgical, and Petroleum Eng, Inc Soc of Petroleum Eng, Fall Meeting, Forty-Fifth Annu, Preprints (Held in Houston, Tex Oct 4-7, 1970), In: Amer Inst of Mining, Metallurgical and Petroleum Eng, Soc of Petroleum Eng, Preprints Nos. SPE-2942, SPE 2944, SPE 2952, SPE 3024, SPE 3027, SPE 3028, SPE 3046, SPE 3048, SPE 3049, and SPE 3050, 1970, 101 p

Amer Medical Assoc, Air Pollut Medical Res Conf, Ninth, Pap, (Held in Denver, Colo Jul 22-24, 1968), In: Archives of Environmental Health, 1814): 458-714, Apr 1969

Amer Nuclear Soc, Annu Meeting, Transactions, Farmakes, Ruth (ed) (Held in Los Angeles, Calif Jun 29-Jul 2, 1970), In: American Nuclear Soc, Hinsdale, Ill. Transactions, 13(1): 452 p, 1970

Amer Petroleum Inst, Div of Production, Pacific Coast District, Spring Meeting, Preprints (Held in Los Angeles, Calif May 13-15, 1969), 1969

Amer Public Health Assoc and Related Organ Annu Meeting, 96th Abstracts (Held in Detroit Mich Nov 10-15, 1968), 1968, 397 p

Amer Public Health Assoc and Related Organ Annu Meeting 97th Abstr (Held in Philadelphia, Pa, Nov 9-14, 1969), 1969, 291 p

Amer Public Health Assoc and Related Organ, Annu Meeting, 98th Abstr (Held in Houston, Tex, Oct 26-30, 1970), 1970, 338 p

Amer Soc of Civil Eng, Natl Structural Engr Meeting, Selected Preprints, (Held in Portland, Ore, Apr 6-10, 1970), In: Amer Soc of Civil Eng, Meeting Preprint Nos. 1171, 1174, 1199, 1220 and 1222, 1970, 124 p Price Per Preprint: $.50

Amer Soc of Mechanical Eng, Textile Engr Div, Conf, Selected Pap, (Held in Greenville, SC, Oct 13-14, 1971), In: Amer Soc of Mechanical Eng, Publication Nos 71-Tex-3 and 71-Tex-4, 1971, 16 p, Price Per Pap, $1.00, $3.00 (Non-Members)

Amer Soc of Mech Eng, Underwater Tech Div. Third Natl Conf, Selected Pap, (Held in Los Angeles, Calif, Nov 16-20, 1969), In: Amer Soc of Mech Eng, ASME Publ No. 69-WA/UNT-1-69-WA/UNT-13: 1969, 103 p, Price Per Pap, $1.00, $2.00 (Non-Members)

Amer Soc of Photogrammetry, Annu Meeting, Thirty-Sixth, Tech Pap, (Held in Falls Church, Va, Mar 1-6, 1970), 1970, 778 p

Amer Soci of Zoologists, Annu Meeting, Sixth-Sixth, Abstr (Held in Boston, Mass Dec 26-31, 1969), Co-Sponsored by Amer Assock for the Advancement of Sci, Boston, Mass, In: Amer Zoologist, 914: 1021-1158, Nov 1969

Amer Water Resources Conf, Fourth, Proceedings, Reprint (Held in NY, NY Nov 18-22, 1968), Spon by Amer Water Resources Assoc, Urbana, Ill, 1969, 8 p

Amer Water Wks Assoc, Annu Meeting, Prog and Selected Abstr (Held in Wash, DC, Jun 21-26, 1970), In: Ind Water Eng, May 1970, 7(5): 56-58

Amer Water Wks Assoc, NC Sect and NC Water Pollut Cont Assoc, Annu Meeting, Forty-Ninth, Proc (Held in Raleigh, NC, Nov 10-12, 1969), In: Amer Water Wks Assoc, NC Sect, 1970, J 45(1):3-88

Amer Water Wks Assoc, Ontario Sect, Annu Conf, Tech Pap, (Held in Toronto, Ontario, Can, Mar 29-31, 1971), 1971, 197 p

Analysis Instru, v 8, Instru Soc of Amer, Symp, 16th Annu Proc, Brochers, C.E.; Fowler, Lewis and McNiell, G.A. (eds), (Held in Pittsburgh, Pa, May 25-27, 1970), Instru Soc of Amer, Pittsburgh, Pa, 1970, 269 p

An Anal of the Public Land Law Review Comm Rep, Symp, Pap and Proc, (Held in Dubois, Wyo, Aug 25-28, 1970), Sponsored by Amer Natl Cattleman's Assoc, Amer Petrol Inst: Conservation Foundation Izaak Walton League of Amer, Rocky Mt Center on Environ Rocky Mountain Oil and Gas Assoc, and US Steel Corp, In: Land and Water Law Review, 1970, 6(1): 473 p

Anal of Ship Data to Predict Long-Term Trends of Hull Bending Moments, Pap, Band, Edward G. U. Amer Bur of Shipping, NY, Nov 1966, 92 p

Animal Waste Mgt, Cornell Univ Conf on Agricultural Waste Mgt, Proc (Held in Syracuse, NY, Jan 13-15, 1969), Spons by NY State College of Agri at Cornell Univ, Ithaca, NY, 1969, 420 p

Annu Directory of Environ Info Sources, Kessler, Myer K and Soccolich, Gene V. (eds), Natl Foun for Environ Control Inc, Boston, Mass, 1971, 286 p, Price: $12.00

Die Anohuren Des Rcten Meeres (Crostacea Decapoda: Paguridea, Galatheidea, Hippidea), Doctoral Thesis, Lewinsohn, Chanan. E. J. Brill, Leiden, 1969, 220 p

Applying Emerging Tech, Natl Conf on Ind Res, Fifth Annu, Proc, Danilov, Victor J. (ed), (Held in Chicago, Ill, Sept 18-19, 1969), Spon by Ind Res, Inc, Beverly Shores, Ind, 1970, 119 p, Price: $10.00

Arctic Drifting Stations: A Rep on Activities Supported by The Office of Naval Res, Sump, Proc, Sater, John E, (ed), (Held in Warrenton, Va, Apr 12-15, 1966), Spon by The Arctic Inst of N Amer, Wash DC, and US Navy Office of Nav Res, Wash DC, Nov 1968, 462 p, Price: $7.50

Art of Organ of the Coastal States Organ, By-Laws, 1970, 8 p

Ash Fouling and Air Pollut Studies Using a Pilot Plant Test Furnace, Pap, Gronhovd, G. H., Harak, A. F. and Tufte, P. H. 1966, 29 p

Ash Util, Symp, Second, Proc, Faber, John H, Coates, Neil H. and Spencer, John D. (eds), (Held in Pittsburgh, Pa, Mar 10-11, 1970), Spons by Natl Coal Assoc, Edison Elec Inst, Amer Public Power Assoc, Natl Ash Assoc, Wash DC, and US Bur of Mines, Pittsburgh, Pa, In: US Bur of Mines, Wash DC, Info Circular No. 8488, 1970, 354p

Aspects of Fish Parasitology, Symp, Pap, Taylor, Angela E. R. and Muller, R. (eds), (Held in London, Eng, Nov 7 1969), Spon by British Soc for Parasitology, In: British Soc for Parasitology, Symp v 8, Blackwell Sci Publ, Oxford, 1970, 171 p, Price: $10.50

Aspects of Sampling Attitudes Towards Solid Waste Problems, Pap, Klee, Albert J., Aug 1971, 22 p

Atlantis Prog, v II, III and IV, Univ of Miami, Fla and Chrysler Corp, Space Div, 1968-1969, 359 p

Atmos Trace Constituents and Atmos Circu, Intl Symp, Pap, Turekian, K. K. and Martell, E. A. (eds), (Held in Heidelberg, Ger, Sept 8-13, 1969), Spon by Intl Assoc of Meteorology and Atmos Physics, Comm on Atmos Chem and Radioactivity, In: J of Geophysical Res, May 20, 1970, 75(15): 2875-3146

Atmos Trans Processes, Pt I: Energy Transfers and Transformation, Reiter, Elmar R., US Atomic Energy Comm, Div of Tech Info, Oak Ridge, Tenn, 1969, 250 p, Price: $3.00

The Augmentation of Sedimentation Tank Efficiency by Upward Flow Clarification, Summary, Sparham, V. R., Dec. 1969, 23 p

Australian Waste Disposal Conf, Pap, Kirov, N. Y. (ed), (Held in Sydney, Australia, Feb 17-19, 1971), Spon by Univ of New South Wales, Dept of Fuel Tech, Sydney: Local Govt Assoc of New South Wales: Australian Inst of Health Surveyors: Clean Air Soc of Australia and New Zealand and Inst of Fuel, Australian Membership, Kingsway Printers Pty, Ltd, Caringbah, N.S.W. 1971, 211 p

Automated Sur Prep and Pre-Construction Primer, Pap, Schmidt, Alfred, 1970, 7 p

The Auto Air Pollut Conf, Sec Annu (Held in Columbia, Mo., Nov 18, 1969), Spon by Univ of Missouri, Exten Div, Col of Eng, Columbia and Missouri Air Conservation Comm, Jefferson City, 1969, 180 p

Auto Disposal, A Natl Problem: Case Studies of Factors that Influence the Accum of Auto Scrap, US Bur of Mines, Wash DC, 1967, 569 p, Price: $4.50

Auto Eng Cong, Selected Pap, (Held in Detroit, Mich, Jan 12-16, 1970) Spon by Soc of Auto Eng, Inc., NY, NY. In: Soc of Auto Engr, Inc. NY, Pap Nos 700094, 70095 and 70096, 1970, 32 p

An Auto Ind Viewpoint of the Impact of the Air Quality Act of 1967, Panel Disc, Bowditch, Fred W, Amer Inst of Chem Engr, NYC, 1969, 7 p, Price: $.75

Barging Ind Liquid Wastes to Sea, Pap, 1970, 13 p

Better Water and Sewer Services for Small Comm in NC, Symp, Proc, (Held in Chapel Hill, NC, Dec 4, 1968). Spon by Univ of NC, Water Resources Res Inst and Inst of Govt, Chapel Hill. In: NC, Univ, Water Resources Res Inst, Rep No. 15, 1969, 119 p

Biochem Toxicology of Insecticides, US-Japan Coop Sci Prog, Keeting, Fifth Pap, O'Brien, R. D. and Yamamoto, Izurc (eds), (Held in Tokyo, Japan, Jun 1969), Co-Spon by Japan Soc for the Promotion of Sci and US Natl Sci Foun, Academic Press, NY, 1970, 218 p, Price: $8.50

Bioenviron and Radiological Safety Feasibility Studies: Atlantic-Pacific Interoceanic Canal, Estuarine and Marine Ecology, v I, Final Rep, and App A, Lowman, F. G.; Martin, J. H.; Ting, R. Y., Barnes, S. S.; Swift, D. J. P.; Seiglie, G. A.; Pirie, R. G.; Davis, R.; Santiago, R. J.; Mc Clinescalera, R.; Gordon, A. G.; Telek, G.; Besselievre, H. L. and Mc Candless, J. B. Battelle Mem Inst Columbus Lab, Ohio, Jun 1971, 143 p

Bioenviron and Radiological, Safety Feas Studies, Atlantic-Pacific Interoceanic Canal, Estuarine and Marine Ecology, v IV, App G through N. Lowman, F. G; Martin, J. H.; Ting, R. Y.; Barnes, S. S.; Swift, D. J. P.; Seigle, G. A.; Pirie, R. G.; Davis, R.; Santiago, R. J; Mc Clin Escalera, R., Gordon, A. G.; Telek, G.; Besselievre, H. L. and Mc Candless, J. B.; Battelle Mem Inst, Columbus Lab, Ohio, Jun 1970, 283 p

A Biological Assay of the Effects of Submerged Eng Exhaust Emis, Pap, Schenck, Norman K. and Weber, Walter J., Jr. 1970, 16 p

Biological Effects of Carbon Monoxide, Conf Pap, Coburn, Ronald F. (ed), (Held in NYC, Jan 12-14, 1970). Spon by NY Acad of Sci, NYC, In: NY Acad of Sci, Annals, Oct 5, 1970, 174(1): 1-430, Price: $30.50

Biological Aspects of Thermal Pollut, Natl Symp Proc, Krenkel, Peter A. and Parker, Frank L. (eds), (Held in Portland, Ore, Jun 3-5, 1968), Spon by Fed Water Pollut Cont Adm, Nashville, Tenn, Vanderbilt Univ Press, 1969, 123 p, Price: $7.95

The Biological Aspects of Water Pollut, Wilber, Charles G., Charles. C., Thomas Publ, Springfield, Ill. 1969, 304 p, Price: $23.75

Biological-Chem Wastewater Treatment, Pap, Stukenberg, John R., 1970, 28 p

Biological Effects of Carbon Monoxide, Conf, Pap, Coburn, Ronald, F. (ed), (Held in NYC, Jan 12-14, 1970), Spon by NY Acad of Sci, NYC, In: NY Acad of Sci, Annu, Oct 5, 1970, 174(1): 1-430, Price: $30.50

The Biolgoical Effects of Oil Pollut on Littoral Comm, Symp, Proc, Carthy, J.D. and Arthur, Don R. (eds), (Held in Pembroke, Wales., Feb 17-19, 1968), Spon by Field Studies Council, London, Eng, Jul 1968, 203 p

The Biological Impact of Pesticides in the Environ, Symp, Proc, Gillett, James W. (ed), (Held in Corvallis, Ore, Nov 18-20, 1969), Spon by Oregon State Univ, Environ Health Sci Center; Dept of Agri Chem, Dept of Fisheries and Wildlife; Dept of Entomology and Graduate Res Council, Corvallis, In: Oregon, State Univ, Corvallis, Environ Health Sci Center, Environ Health Sci Series No 1, 1969, 210 p, Price: $10.00

Biological Implications of the Nuclear Age, Symp, Proc, (Held in Livermore, Calif, Mar 5-7, 1969). Spon by Univ of Calif, Lawrence Radiation Lab, Bio-Medical Div, Livermore and US Atomic Energy Comm, Div of Tech Info Oak Ridge, Tenn, Dec 1969, 349 p, Price: $3.00 (Pbk.).

The Biological Recovery of the Clinch River Following a Fly Ash Pond Spill, Pap, Cairns, John, Jr., Crossman, John S. and Dickson, Kenneth L., 1970, 23 p

The Biological Significance of Estuaries, Symp, Pap, Douglas, Phillip, A. and Stroud, Richard H. (eds), (Held in Houston, Tex, Feb 13, 1970), Spon by Sport Fishing Inst, Washington, DC: Sportsmen's Clubs of Tex, Inc. Houston and Natl Wildlife Fed, Wash, DC, Mar 1971, 118 p

The Biology of and Fishery for Tuna and Other Pelagic Fishes of the Northeastern Pt of the Indian Ocean, Osipov, V. G., US Bur of Sport Fisheries and Wildlife, Narragansett Marine Game Fish Res Lab, RI, Dec 1968, 15 p, Price: $3.00

Biophysical Res on the Cetagean's Ear Bones, Doctoral Thesis, Giraud-Sauveur, Dominique, Univ of Paris, Animal Acoustics Lab, France, Oct 1968, 117 p, Price: $.65

Boat Pollut, Interstate Conf, Pap, (Held in NYC, Apr 17, 1968), Spon by Interstate Sanitation Comm, 1968, 118 p

Bod Removal and Stabilization of Anaerobic Lagoon Effluent Using a Rotating Biological Contractor, Pap, Chittenden, Jimmie A. and Wells, W. James, Jr., 1970, 13 p

Bogue Sound Treasure Hunt, Teacher Unit, Hon, Will and Chapman, Frank. Carteret Cty Publ Schools, Beaufort, NC, 1970, 20 p

A Bird Survey of the Activities of the World Meteorological Organ Relating to Human Environ, Rep, Sec of the World Meteorological Organ, Geneva, Switzerland, Jun 1970, 24 p

Buffer Zones for Sanitary Landfills, Pap, Mc Collough, Jack E. and Pacey, John G. Terratech, San Jose, Calif, 1970, 20 p

Bur of Leached Hulls at the W Valley Plant, Rep, Nuclear Fuel Serv, Inc, W Valley, NY, 1969, 34 p

Carles, Connectors and Penetrators for Deep Sea Veh, Meeting, Presentations and Discussions, (Held in Bethesda, Md, Jan 15-16, 1969), Spon by US Dept of the Navy, Wash DC, 1969, 390 p

Calif Advisory Comm of Marine and Coastal Resources, 5th Meeting, Proc, (Held in Sacramento, Calif, Jun 6-7, 1969) State of Calif, 1969, 70 p

Calif Advisory Comm on Marine and Coastal Resources, 6th Meeting, Proc, (Held in Eureka, Calif, Sept. 19-20, 1969) State of Calif, 1969, 125 p

Calif Advisory Comm on Marine and Coastal Resources, Eighth Meeting, Proc, (Held in Santa Cruz, Calif, May 1-2, 1970) State of Calif, 1970, 92 p

Canadian Agric Chem Assoc, Meeting and Conf, Eighteenth Annu, Pap, (Held in Jasper, Alberta, Can, Sept 13-16, 1970) 1970, 79 p

Canadian Wood Chem Symp, Third, Abstr (Held in Vancouver, BC, Canada, Jun 24-26, 1970), Jointly Spon by Canadian Pulp and Pap Assoc, Tech Sec, Montreal and Chem Inst of Canada, Ottawa, Ontario, 970, 74 p

Carbonate Sedimentation and Environ, Shark Bay, W Australia, Logan, Brian W.; Davies, Graham, R.; Read, James F. and Cebulski, Donald E, Amer Assoc of Petrol Geologists, Memoir No 13, Tulsa, Okla, 1970, 230 p

Catalogue of Main Marine Fooling Organisms, v I: Barnacles, Organ for Econ Co-op and Devel Pts, 1963, 47 p, Price $3.50

Catalogue of Main Marine Fouling Organisms, v II: Polyzoa, Organ for Econ Co-op and Devel, Pts, Mar 1965, 83 p, Price: $2.00

Catalogue of Main Marine Fouling Organisms, v III, Serpulids, Organ, for Econ Co-op and Devel, Pts, 1967, 79 p, Price: $2.00

Catalogue of Main Marine Fouling Organisms, v IV: Ascidians, Organ for Economic Co-op and Devel, Pts, 1969, 34 p, Price: $4.50

Catalogue of Marine Sci Movies, Filmstrips, and Slides, Chapman, Frank L, ESEA Title III Publ, Reg Marine Sci Proj, Cateret Cty Publ Schools, Beaufort, NC, Mar 1969, 36 p

Challenge for Survival, Symp, Pap, Dansereau, Pierre (ed), (Held in NY, NY, Apr 25-26, 1968), Spon by the NY Botanical Garden, Columbia Univ Press, NY, 1970, 236 p, Price: $7.95

Challenge: The Environ, Conf on Prob Oriented Approaches to the Environ by Govt, Ind, Banking, Conser, Law, Rep, De Ville, William B. (ed) (Held in Bloomington, Ind, Oct 29-30, 1970), Spon by Indiana Univ Foun, Aerospace Res Appli Center, Environ Systems Applic Center, Bloomington, 117 p

Changing Environ Hazards: Challenges of Comm Health, Rep of the Task Force on Environ Health, Natl Comm of Comm Health Serv, Wash DC, Publ Affairs Press, Wash DC, 1967, 101 p, Price: $2.00

Chem Conc of Pollut Lead Aerosols, Terrestrial Dusts, and Sea Salts in Greenland and Antarctic Show Strata, Rep, Murdzumi, M.; Chow, Tsaihwa, J, and Patterson, C, Univ of Calif, Scripps Inst of Oceanography, La Jolla, 1969, 110 p, Price: $.65

Chem Fallout: Current Res and Persistent Pesticides, Rochester Conf on Toxicity, Proc, Miller, Morton W. and Berg, George G (eds), (Held in Rochester, NY, 1968), Spon by Univ of Rochester, School of Medicine and Dentistry, Dept of Radiation Biology and Biophysics, NY, 1969, 551 p, Price: $22.50

Chem Markets in Water and Wastewater Treatment, Rep, Env Sci Serv Corp, Stamford, Conn, 1968, 80 p, Price: $20.00

Chemurgy--For Better Environ and Profits, Conf, 32nd Annu, Proc, (Held in Wash DC, Oct 22-23, 1970), Spon by Ehemurgic Council, NYC, 1970, 137 p, Price: $11.00

The Chena River: A Study of a Subarctic Stream, Frey, Paul J.; Mueller, Ernst W. and Berry, Edward C. US Dept of the Int, Fed Water Qaulity Adm, Alaska Water Lab, Col, Oct 1970, 105 p

Chick Edema, Statement Before the Subcomm on Energy, Natural Res, and the Environ of the Senate Comm on Commerce, Verrett, H. Jacqueline. Apr 15 1970, 14 p

Chlorinated Hydrocarbons in the Marine Environ, Rep, Goldberg, Edward C, Butler, Philip; Meier, Paul, Menzel, David; Paulik, David; Risebrough, Robert and Stickel, Lucille F. Natl Acad of Sci, Comm on Oceanography, Panel on Monitoring Pesticides in the Marine Environ, Wash DC, 1971, 47 p

Chronological List of Gen Mtrs Contrib to Air Pollut Studies, Pap, Gen Mtrs Tech Center, Off of Publ Rel, Warren, Mich, Aug 1970, 25 p

Civil Eng in the Oceans, II Conf, Proc, (Held in Miami Beach, Fla, Dec 10-12, 1969), Spon by Amer Soc of Civil Engr, NY, 1970, 1267 p, Price: $10.00

Clarification-Absorp in the Treatment of Municipal and Ind Wastewater, Pap, Hager, D. G. and Reilly, P. B. 1969, 15 p

Clean Air Cong: Second Intl, Summ of Activities, Spon by Intl Union of Air Pollut Prevention Assoc, In: Air Pollut Control Assoc, J, Feb 1971, 21(2): 51-65

A Clean Air Environ for Calif Proj Clean Air, A Prog Rep to the Regents of the Univ of Calif, Mar 20, 1970, 103 p

Clean Air Yr Bk 1972-72, Natl Soc for Clean Air, Great Britain, 1971, 88 p, Price: 60p

Cleaning our Environ: The Chem Basis for Action, Priority Recomm with Supporting Discussion, Supplement, Amer Chem Soc, Comm on Chem and Publ Affairs and Comm on Environ Improvement, Wash DC, Amer Chem Soc, Wash DC, 1971, 26 p, Price: $1.00

Clean Water in the '70's Anal and Recomm Changes for the Grant-In-Aid Prog of the Fed Water Pollut Control Act, Pap, Natl League of Cities and US Conf of Mayors, Wash DC, Jan 1970, 20 p

Cleaner Air Week Workshop, Transcript, (Held in New Brunswick, N.J., Sept 1967), Sponsored by Putgers Univ, College of Agric and Environ Sci, Dept of Environ Sci, New Brunswick, NJ, 104 pages, 1967

Cleaning Our Envirn: The Chem Basis for Action , Rep, Amer Chem Soc, Comm on Chem and Public Affairs, Subcomm on Environ Improve, Wash DC, 256 p, Proce: $2.75

Clearing the Air, A Layman's Guide to Atmosph Purity, Amer Petro Inst, Comm on Public Affairs, NY, NY, 19 p, 1969

Climatic Fluctuations and Their Possible Relations to Interactions Between the Atmosph-Ocean-Icecaps, Paper, Eriksson, Erik, Intl Meteor Inst in Stockholm, Sweden, 10 p, 1969

Coal Mine Drainage Res, Symp, Third, Papers, (Held in Pittsburgh, Pa, May 19-20, 1970), Sponsored by Ohio River Valley Water Sanitation Comm, Coal Ind Advisory Comm, Cincinnati, 413 p, 1970, Price: $7.00

Coast Guard District Civilian Submersible Search and Rescue Conf, Eleventh, Proc, (Held in Long Beach, Calif, Feb 17, 1970), 133 p, 1970

Coastal and Estuarine Waters in the United States, Index to Res, Ditsworth, George R., U.S. Dept of the Interior, Federal Water Pollut Contr Admin, NW Region, 36 p, Sept 1969

Coastal Engr, Eleventh Conf, Proc, v I & II, (Held in London, England, Sept 1963), Sponsored by Amer Soc of Civil Engr, Coastal Engr Res Counc, NY and Inst of Civil Engr, London, 2358 p, 1969, Price: $12.00

Coastal Engr in Japan, v Xii, Iwasaki, Toshio (ed), Japan Soc of Civil Engr, Comm on Coastal Engr, Tokyo, 194 p, Dec 1969, Price: $4.50, (pbk.)

Coastal/Estuaring Pollut, Annotated Bibliography, Sinha, Evelyn, Ocean Engr Info Serv, Ocean Engr Info Series, v 3, La Jolla, Calif, 95 p, 1970, Price: $15.00

Coastal Recreation and Holidays, v 1, Special Study Rep, Tanner, M.F., Countryside Comm, Coastal Preservation and Development, Her Majesty's Stationery Office, London, 105 p, 1969, Price: $3.78

The Coastal Resourc Mgt Program of Texas: A Summary, Rep to the 62nd Texas Legislature, Interagency Natural Resourc Council, Austin, 16 p, Dec 1970

Coastal Wastes Mgt, Study Session, Background Papers, v I, Ludwigson, John (ed), (Held in Jackson Hole, Wyo, July 6-12, 1969), Spon by Natl Academy of Sci, Comm on Oceanography and Natl Academy of Engr, Comm on Ocean Engr, Wash DC, 422 p, 1969

Cod Tagging Experiments in Dutch Coastal Waters, Paper, Daan, N., Intl Council for the Exporation of the Sea, Depersal Fish (Northern) Comm, 9 p, 1969

Coho Salmon Mortality and Dot in Lake Mich, Paper, Johnson, H. E., and Pecor, C., Wildlife Mgt Inst, Wash DC, 8 p, 1969

Colloque Intl D'Oceanographi Medicale, Fourth, Proc, (Held in Napes, Italy Oct 2-5, 1969), In: Revue Intl D'Oceanographie Medicale, 17: 47-210, 1970

Combating Pollut Created by Oil Spills, v 1: Methods, Rep to U.S. Dept of Transp, U.S. Coast Guard, A. D. Little, Inc, Cambridge, Mass, 163 p, June 30, 1969, Price: $0.65

Combined Sewer Overflow Abatement Tech, Symp on Storm and Combined Sewer Overflow, Papers, (Held in Chicago, Ill, June 22-23, 1970), Spon by U.S. Dept of Interior, Federal Water Quality Admin, Wash DC, In: U.S. Dept of the Interior, Federal Water Quality Admin, Wash DC, Res Series 11024-06, 340 p, 1970, Price: $3.50

Combustion, Intl Symp, 12th, Abstr, (Held in Poitiers, France, July 14-20, 1968), Spon by Combustion Inst, Pittsburgh, Pa, 260 p, 1968

Community Action Program for Air Pollut Cont, Booklets, Natl Assoc of Counties Res Foun, Wash DC, 103 p, 1966

Community Action Program for Water Pollut Cont, Rep, Natl Assoc of Counties Res Foun, Wash DC, 188 p, July 1967

Composting--Waste Recycling, Natl Conf, 1st, Proc, (Held in Denver, Colo, May 20-21, 1971), Spon by Keep Colo Beautiful Inc: Denver, Colo and Rodale Press, Inc, Emmaus, Pa, 127 p, 1971

A Comprehensive Assessment of Solid Waste Problems, Practices, and Needs, Executive Office of the Pres, Office of Sci and Tech, Wash, DC, 120 p, May 1969

A Comprehensive Coastal Resourc Plan for the Texas Gulf Coast Region, Program Guideline, Interagency Natural Resourc Counc, 11 p, 1969

Computers are Better on the Shore, Flittner, G. A., Paper, 6 p, 1969

Computers in Oceanography, Paper, Rosenfeld, M. A. and Bowin, C. D., 18 p, 1969

Concepts of Pest Mgt, Conf, Proc, Rabb, R. L. and Guthrie, F. E. (eds), (Held in Raliegh, NC, March 25-27, 1970), Co-Spon by NC State Univ, Inst of Biol Sci, Raleigh and Entomological Soc of Amer, College Park, Md, 252 p, 1970

Conf on Aircr and the Environ, Part I, Proc, (Held in Wash DC, Feb 8-10, 1971), Spon by U.S. Dept of Transp, Wash DC and Soc of Automotive Engr, Inc., NY City, 309 p, 1971

Conf on Containerization, 9th Annu, Papers, (Held in NY, NY, Jan 28-29, 1969)

Conf on Inorganic Lead, Summary and Papers, Kehoe, R. A. (ed), (Held in Amsterdam, Netherlands, Nov 28-29, 1968), Spon by Intl Assoc of Occu Helath, In: Archives of Environ Helath, 23(4): 245-311, Oct 1971

Congress and the Nation's Environ: Environ Affairs of the 91st Congress, Library of Congress, Congressional Res Serv, Environ Policy Div, Wash, U.S. Govt Printing Office, Wash, DC, 302 p, Feb 10, 1971, Price: $1.25

Congress of Food Sci and Tech, 3rd, Abstr, (Held in NY, NY, April 26-27, 1970), 124 p, 1970

Congress on Environ Helath, 8th, Sel Papers, (Held in NY ,NY, April 26-27, 1971), Spon by Amer Med Assoc, Chicago, Ill, 42 p, 1971

Conservation/Environ Organ, Directory, Elling, V., Northern States Power Co, Environ Affairs Dept, Minneapolis, Minn, 136 p, June 1, 1971,

Conservation of Our Air Environ, Teachers' Conf, Proc, (Held in Univ Park, Pa, April

Consider the Environ Effects of Energy Generation on Lake Mich, Statement, Fetterolf, C. M., Jr., Mich Dept of Natural Resourc, Grand Rapids, 12 p, 1970

Considerations in Measurement of Community Noise, Paper, Brandforel, P., 18 p, 1967

Control of Cooling Tower Mist, Paper, Maurer, R. H., 7 p, 1970

Control of Dusts, Smokes, and Noxious Odors, Air Pollut Conf, 3rd Annu, Proc (Held in Columbia, Mo, Nov 17, 1970), Spon by Univ of Missouri, Extension Div, College of Engr, Columbia and Missouri Air Conservation Comm, Jefferson City, 129 p, 1970

Control of Gaseous Emissions, Training Manual, U.S. EPA, Natl Air Pollut Control Admin, Office of Manpower Devel, Res Triangle Park, NC, 264 p, 1971

Control of Smoke, Visible Emissions and Particulates, Reg 7, Oklahoma State Dept of Helath Environ Helath Serv, Air Pollut Control Div, Oklahoma City, 4 p, June 21, 1971

Control of the Emission of Particulate Matter from Indust and Other Processes and Operations. Reg 8, Oklahoma State Dept of Helath, Environ Health Serv, Air Pollut Control Div, Oklahoma City, 6 p, June 21, 1970

Control of Vehicle Emissions after 1974. A rep to the Calif Air Resourc Board by the Tech Advisory Comm, 41 p, Nov 19, 1969

Cooling Tower Design Criteria and Water Treatment, Paper, Motley, F. W. and Hoppe, T. C., 16 p, 1970

Cooling Towers, The Environ and the Futhre, Paper, Aynsley, E., IIT Res Inst, Chicago, Ill, 12 p, 1970

Cooling Water Treatment Manual, Natl Assoc of Corrosion Engr, Tech Practices Comm Publ 1, Houston, Texas, 39 p, 1971

Coordination of Ind Air and Water Quality Programs as an Effective Mgt Policy, Paper, Tihansky, D. P. In: Rand Corp, Repts Dept, Santa Monica, Calif, Publ P-4551, 5 p, Jan 1971, Price: $0.50

The Corp and the Environ, Rep, Bolton, R. E. Williams College, Center for Environ Studies, Williamstown, Mass, 43 p, June 1969

The Corrosion of Metals in Aqueons Environ Over Extended Periods, Paper, Southwell, C. R. and Alexander, A. L., 46 p, 1969

Council on Environ Quality, Address, Cahn, R., 14 p, 1970

Crisis in Oregon Estuaries, A Summary of Environ Factors Affecting Oregon Estuaries, Wick, W. Q. (Ed), Oregon STate Univ, Maring Advirory Program, Corvallis, 8 p, 1970

Critique and STudy of the Govt of the State of Fla and its Capability for Meeting the Ocean Challenge, Rep, Hull, E. W. Seabrook, State of Fla, Comm on Marine Sci and Tech, 99 p, Aug 15, 1969

Cultivation of Marine Organisms and its Importance for Marine Bio, Intl Symp, Sel Papers, Kinne, D. and Bulnheim,. H. P. (eds) (Held in Hamburg Germany, Sept 8-12, 1969), Spon by Biologische Anstalt Holgoland, Hamberg, Germany, In: Helgoland Wissenschaftliche Meeresuntersuchungen, 20(1-4): 1-721, May 1970

Culture of Blu, Channel and White Catfish in Brackish Water Ponds, Paper, Perry, W. Guthrie, Jr. and Avault, J. W., Jr, 23 p, 1969

Current Res into the Effects of Reservoirs on Water Quality, Specialty Conf, Proc, Elder, R. A.; Krenkel, P. A. and Thackston, E. L. (eds), (Held in Portland, Ore, July 1965), Spon by Amer Soc of Civil Engr, Hydraulics Div and Sanitary Engr Div, NY, In: Vanderbilt Univ, Dept of Environ and Water Resourc Engr, Nashville, Tenn, Tech Rep 17, 397 p, Jan 1969, Price: $6.00

Data and Instrumentation for Water Quality Mgt, Natl Symp, Proc, Kerrigan, J. E., (ed), (Held in Madison, Wisc, July 21-23, 1970), Spon by Joint Comm on Water Quality Mgt Data, Conf of State Sanitary Engr and Univ of Wisc, Water Resourc Centr, Madison, 534 p, Dec 1970, Price: $5.00

Deep Ocean Dumping of Baled Refuse, Sub-Council Rep, Natl Ind Pollut Cont Council, Prog and Systs Engr Sub-Council, Wash DC, Feb 1971, 15 p, Price: $.20

Deep Ocean Search by Visual, Acous and Magnetic Sensors, Pap, Buchanan, C. L., 1969, 34 p

Defining the Calif Publ Int in Coastal Zone Mgt, Annu Rep, Second, Calif Advisory Comm on Marine and Coastal Res, Jan 1970, 104 p

Design and Fab of Pres Hulls for Deep Diving Submersibles, Pap, Hagan, Richard H. Sun Shipbuilding and Dry Dock Co, Aero/Hydro Space Div, Chester, Pa, 1969, 30 p

Design of a Completely Mixed Wastewater Treatment Plt, Pap, Thomas, Ariel A.: Seid, Sol and Arthur, John, 1970, 12 p

Design of a Computer-Assisted Coastal, Info Syst, Rep, Campbell, Robert D, Matrix Res Co, Area Systs Div, Alexandria, Va, Sept 15, 1969, 130 p, Price: $.65

Devel in Polography, Sem, Proc, Thompson, Brian J. and De Velis, John B. (eds), (Held in Boston, Mass, Apr 14-15, 1971), Spon by Redondo Beach, Calif, In: Soc of Photo-Optical Instru Engr, S.P.I.E. Sem Proc, 1971, 254 p

Devel of Air Qual Standards, Symp, Proc, Atkisson, Arthur and Gaines, Richard S. (eds), (Held in Santa Barbara, Calif, Oct 23-25, 1969), Spon by Natl Air Conser Comm, Univ of Calif, Air Pollut Cont Inst: Christmas Seal Agencies of So Calif and Eight Tuberculosis and Respiratory Disease Assoc of So Calif Environ Res, Inc. Riverside, Calif, Charles E. Merrill Publ Co, Columbus, O, 1970, 220 p, Price: $12.95

Devel in Water Qual Res, Jerusalem Intl Conf on Water Qual and Pollut Res, Proc, Shuval, Hillel I (ed), (Held in Jerusalem, Israel, Jun 1969), Spon by Natl Coun for Res and Devel, Jerusalem: The Technicon-Israel Inst of Tech, Haifa; Hebrew Univ of Jerusalem; Israel Assoc of Architects and Engr and Mekopot Water Co, Tel Aviv, Ann Arbor-Humphrey Sci Publ, Ann Arbor, 1970, 312 p, Price: $17.50

Diagnosis and Treatment of Deposited Radionuclides, Symp, Proc, Kornberg, H. A. and Norwood, W. D. (eds), (Held in Richland, Wash, May 15-17, 1967) Spon by US Atomic Energy Comm, Div of Biology and Medicine, Excerpta Mecica Foun, Monographs of Nuclear Medicine and Biology No. 2 Nov 1968, 681 p, Price: $42.00

Diagnosis of Fluorosis in Cattle, Pap, Shupe, James L., 1966, 14 p

Dimen of Water Mgt, Ohio Water Resources Conf, First Annu, Proc, Drobny-Neil L. (ed), (Held on Mar 24, 1970), Spon by Amer Water Res Assoc, Ohio Sect, Columbus and Ohio Dept of Natl Res, Columbus, 1970, 136 p

Directory of Academic Marine Sci Prog in New England, Booklet, New England Marine Res Info Prog, Narragensett, RI, Dec 1969, 55 p

A Directory of Oceanographers in the US, Vetter, Richard C. Natl Academy of Sci, Wash DC, 1969, 80 p, Price: $2.50

Directory of Organ Concerned with Environ Res, Mordy, Wendell, A. and Sholtys, Phyllis A., State Univ Coll, Lake Erie Environ Studies, Fredonia, NY, Jan 1970, 150 p, Price: $2.00

The Disaster Lobby, Pamphlet, Sheppard, Thomas R., Jr., 1971, 13 p

Discharge of Selected Rivers of the World, v I, Gen and Regime Characteristics of Stations Selected, A Contrib to the Intl Hydrological Decade, United Nations Educational, Sci and Cultural Organ, Paris, 1969, 70 p, Price: $6.00

A Disc of Recent Res in Air Pollut, Pap, Forrest, J. S. and Mason, B. J. (eds), (Held in London, Eng, Nov. 14, 1968), In: Royal Soc of London, Philosophical Transac, Series A: Mathematical and Physical Sci, Nov 13, 1969, 265(1161): 139-318

A Disc of the Origin and Treatment of Noise in Ind Environ, Pap, Richards, E. J. (ed), (Held in London, Eng, Mar 9-10, 1967). In: Royal Soc of London, Philosophical Transac, Series A, Math and Phys Sci, Dec 5, 1968, 263(1142):269-480

Disposal Hazards of Certain Chem Warfare Agents and Munitions, Rep, Natl Academy of Sci, Ad Hoc Advisory Comm, Wash DC, June 24, 1969, 15 p

Disposal of Auto Scrap in Conn, Res and Mkg Study, Conn. Develop Comm, Business and Ind Develop Div, Hartford, Conn, Feb 1967, 104 p

Disposal of Liquid and Particulate Wastes to the Ocean, Pap, Baumgartner, D. J. 1969, 30 p

Diurnal Changes in Trawl Catches of Plaice, Dab and Sole, Pap, De Groot, S. J., Intl Coun for the Explor of the Sea, Gear and Behavior Comm, 1968, 6 p

Diurnal Variation and Seasonal Changes in Trawl Catches of Turbot (Scophthalmus Maximum L.) Pap, De Groot, S. J. Intl Coun for the Exploration of the Sea, Gear and Behavior Comm, 1968, 6 p

1967 Domestic Refinery Effluent Profile, Rep, Amer Petrol Inst, Comm for Air and Water Conser, Crossley, S-D Surveys, Inc Sept 1968, 67 p

Dredging Seminar, Second, Proc, Herbich, John B. and Basco, David R. (eds) (Held in Coll Station, Tex, Nov 21, 1969), Spon by World Dredging Assoc, Gulf Chapter and Tex A&M Univ, Center for Dredging Studies, Coll Station. In: Tex A&M Univ, Sea Grant Prog, Sea Grant Publ No. 70-113, Jun 1970, 93 p

Drug Residues in Animal Tissues, Symp, Pap, Assoc of Official Analytical Chem, Eighty-Third Annu Meeting, (Held in Wash DC, Oct 13-16, 1969), In: Assoc of Official Analytical Chem, J, Mar 1970, 53(2): 211-228, and May 1970, 53(3): 450-648

A Dynamic Theory for the Design of Oxidation Ponds, Pap, Marais, G.V.R. Inst of Water Pollu Cont, S African Branch, 1970, 81 p

Earth Sci Symp on Hudson Bay, Proc, Hood, Peter J. (ed), (Held in Ottawa, Can, Feb 19-20, 1968), Spon by the Natl Advisory Comm on Res in the Geological Sci, Canada and the Natl Res Council, Associate Comm on Geodesy and Geophysics, Canada. In: Canada, Geological Survey, Ottawa, Pap No. 68-53, 1969, 391 p, Price: $5.00

Ecological Effects of Weather Modification: A Prob Analysis, Rep, Cooper, Charles F. and Jolly, William C. Univ of Mich, School of Natural Resources, Dept of Resource Planning and Conservation, Ann Arbor, May 1969, 163 p

Ecological Invest Related to Thermal Discharges, Pap, Adams, James R.: Gormly, H. James and Doyle, M. J. Jr., 1969, 18 p

Ecological Prob in the Marine Environ, Natl Biological Congress, Preprints, (Held Nov 10, 1970), Spon by Battelle Memorial Inst, Columbus Lab, Oh, Amer Inst of Biological Sc, Wash DC, and Fed of Amer Soc for Experimental Biology, 1970, 49 p

An Ecologist's Sugg for Environ Improvement in Oregon, Pap, Cook, Stanton, A. 1970, 7 p

Ecology and Lane Use of the Supply Ponds Natural Area, Branford, Conn, Rep, Cooper, Diana S and Hotaling, Wm L, Yale Univ, School of Forestry, New Haven, Conn, 1970, 62 p, Price: $2.00

Ecology Begins at Home: A Household Environ Handbook, Revised Edition, San Fernando Valley State Coll, Northridge, Calif, 16 p

Ecology, Environ Quality and Publ Wks, Course Notes, Kerr, Farnum W., (Held in Berkeley, Calif, Spring 1971), Spon by Univ of Calif Ext, Inst of Trans and Traffic Engr, Berkeley, 1971, 94 p, Price: $3.00

Economic Aspects of Clean Air, Pap, Elias, Robert J, 1971, 11 p

Economic Impact of Pollut Abatement, Address, Brimmer, Andrew F, Jun 1971, 20 p

Economics of Clean Water, v I, II, and III, Third Rep to the Congress on Natl Requirements and Cost of Water Pollut Control, US Dept of the Interior, Fed Water Pollut Control Admin, Wash DC, Mar 1970, 720 p, Price: $6.00

Economics of Recycling, Pap, Lehto, Bjorn O, Jan 1970, 15 p

Economics of Waste Pap Recovery, Pap, Whitfield, W, 1970, 20 p

Educational Syst for Operators of Water Pollut Cont Facilities, Conf, Proc, Austin, John H and Kesler, John (eds), (Held in Atlanta, Ga, Nov 3-5, 1969), Spon by US Dept of the Interior, Fed Water Pollut Cont Adm, Atlanta, Ge and Clemson Univ, SC, 1969, 421 p

Effect of Auto Emission Requirements on Gasoline Characteristics, Amer Soc for Testing and ,ateroa;s. Annu Meeting, Seventy-Third, Symp Pap, (Held in Toronto, Ont, Can, Jun 21-26, 1970), In: Amer Soc for Testing and Materials, Phil, Pa, Tech Publ No. 487, Apr 1971, 164 p, Price: $9.50

Effect of Chronic Exposure to Low Levels of Carbon Monoxide on Human Health, Behavior, and Performance, Rep, Natl Res Council, Div of Medical Sci, Comm on Effects of Atmospheric Contaminants on Human Health and Welfare, Natl Academy of Sci and Natl Academy of Engr, Wash DC, 1969, 66 p

The Effect of Major Ind Spills Upon Stream Organisms, Pap, Cairns, John Jr., Crossman, John S, Dickson, Kenneth L, and Herricks, Edwin E, 1971, 26 p

The Effect of Temp in the Spawning, and Nursery Areas on Recruitment of Autumn Spawning Herring in the North Sea, Pap, Postuma, K. H., Intl Council for the Exploration of the Sea, 1968, 15 p

Effects and Movements of Paraquat in the Water, Pap, Silvo, Olavi E. J. 1970, 22 p

Effects of Abatement of Domestic Sewage Pollut on the Benthos, Volumes of Zooplankton, and the Fouling Organisms of Biscayne Bay, Fla, Mc Nulty, J. Kneeland, In: Miami, Univ of Coral Gables, Fla, Inst of Marine and Atmos Sci, Studies in Tropical Oceanography No. 1, Univ of Miami Press, Coral Gables, Fla, Mar 1970, 107 p

The Effects of Aerial Forest Fertilization on Water Quality for Two Streams in the Capitol Forest, Paper, McCall, M., Wash State Dept of Ecology, 23 p, Oct 1970

The Effects of Air Pollut on Plants and Soil, Webster, C.C., Agric Res, Council, London, 55 p, 1967

The Effects of Dredging on Water Quality in the NW, Rep, O'Neal, G. and Sceva, J., U.S. EPA, Office of Water Programs, Region X, Seattle, Wash, 163 p, July 1971

Effects of Fertilizers on Water Quality, A Collection of Abstr and Refs Dealing with the Relationships Between Fertilization of Agric Lands and Chem Composition of Surfaces and Ground Waters, Tenn Valey Authority, Natl Fertilizer Devel Centr, Muscle Shoals, Ala, 107 p, 1969

Effects of Microwaves and Radio Frequency Energy on the Central Nervous Syst, Rep, Frey, A.H., Randomline, Inc., Willow Grove, Pa, 9 p, Sept 1969

Effects of Salinity on Growth and Survival of Channel Catfish, Iotalurus Punctatus (Rafinesque), Eggs Through Yearlings, Dissertation, Allen, K.D., Louisiana College, Dept of Marine Sci, Baton Rouge, 63 p, 1970

Effects of Watershed Changes on Streamflow, Water Resour Symp, 2nd, Papers, Moore, W.L. and Morgan, C.W. (eds),(Held in Austin, Tex, Oct, 1968), Spon by Univ of Tex, Centr for Res in Water Resourc, Austin, Univ of Tex Press, Austin, 289 p, 1969, Price: $12.50

Egg Weights of N Sea Herring (Clupea Harengus L.), Paper, 11 p, 1969

Elements of Marine Ecology, An Intro Course, Tait, R.V., Plenum Press, NY, 277 p, 1968, Price: $12.50

Emission Inventories: State of Calif, Resourc Agency, Calif Air Resourc Board, Sacramento, 59 p, Nov 1969

Energy and the Environ, Paper, Winter, T.C., Jr, 35 p, May 1971

The Engr and the Environ, Inst of Elec Engr, Mersey and N Wales Centr, Session Meet, (Held in 1969-70), 63 p, 1970

Engr Analysis of Emissions Control Tech for Sulfuric Acid Mfg Processes, v 11, Lit Search, Chem Construction Corp, Consulting Div, NY, NY, 79 p, March 1970, Price: $3.00

Engr Aspects of Thermal Pollut, Natl Symp, Proc, Parker, F.L. and Krenkel, P.A. (eds), Held in Nashville, Tenn, Aug 14-16, 1968, Spon by Fed Water Pollut Control Admin, Wash DC and Vanderbilt Univ, Nashville, Tenn, Vanderbilt Univ Press, 369 p, 1969, Price: $7.95

Engr for the Deep Ocean, Joint Symp, 1st Annu, (Held in Notre Dame, Ind, Dec 13-14, 1968), Spon by Univ of Notre Dame, Ind, 37 p, 1969

Engr for the Deep Ocean, Joint Symp, 2nd Annu, Abstr, (Held in Northampton, Mass, April 13-14, 1970), Spon by Univ of Notre Dame, Thesis Projs, Ind and Univ of Mass, Amherst, 34 p, 1970

Engr in the Ocean Environ, Conf, Digest of Tech Papers, 1st ed, Winner, L. and Winner, B.K. (eds)(Held in Panama City, Fla, Sept 21-24, 1970) Spon by Inst of Elect and Electronics Engr, Inc, NY City, Lewis Winner, NY, NY, 259 p, Sept 1970.

Engr in the Ocean Environ, Conf, Record, (Held in San Diego, Calif, Sept 21-24, 1971), Spon by Inst of Elect and Electronics Engr, Inc, Oceanography Coordination Comm, NY City, 394 p, 1971, Price: $12.00 (non-members)

Environ and the Food Processor, Food Engr Forum, Proc, (Held in Houston, Tex, Nov 2-4, 1970), Spon by Dairy and Food Ind Supply Assoc, Inc, Wash DC and Amer Soc of Agric Engr, St. Joseph, Mich, 116 p, April 1971, Price: $2.50

Environ: The Quest for Quality, Conf, Proc, Summary, (Held in Wash DC, Feb 18-20, 1970), Spon by: U.S. Natl Comm for the Intl Bio Program and the Public Affairs Council, Wash DC, 24 p, 1970

Environ 1975 -- Pollut in Alberta, Symp, Proc, Brookes, D.A. and Hyres, M.T. (eds), (Held in Calgary, Alberta, Canada, Feb 7, 1970) Spon by Univ of Calgary, Bio Sci Soc, Alberta, Canada, 64 p, 1970, Proce: $1.00

Environ Assessment of Resourc Devel, Symp, Proc, (Held in Sacramento, Calif, June 14-15, 1971), Spon by Sacramento State College, Inst for Tech and Soc, Calif, 190 p, 1971

Environ Awareness, Inst of Environ Sci, Colo Chapter, Annu Session, 2nd, Papers, Lillywhite, M. and Martin, C. (eds), (Held in Los Angeles, Calif, April 26-30, 1971), 85 p, 1971

Environ Education: Education that Cannot Wait, Booklet, Whiting, C., U.S. Dept of Health, Education and Welfare, Office of Education, Wash DC, 48 p, 1970

Environ and Water Resourc Engr Conf, 8th Annu Proc, Thackston, E.L. and Benedict, B.A. (eds), (Held in Nashville, Tenn, June 5-6, 1969), Co-Spon by Vanderbilt Univ, Sch of Engr: Tenn Stream Pollut Control Board and Tenn Dept of Public Health, In: Tenn Dept of Environ and Water Resourc Engr, Tech Rep 20, 248 p, 1969, Price: $4.00

Environ and Water Resourc Engr Conf, 9th Annu, Proc, Thackston, E.L. and Benedict, B.A. (eds), (Held in Nashville, Tenn, June 4-5, 1970), Co-Spon by Vanderbilt Univ, Sch of Engr: Tenn Stream Pollut Control Board and Tenn Dept of Public Health, In: Vanderbild Univ, Dept of Environ and Water Resourc Engr, Tech Rep 22, 204 p, 1970, Proce: $4.00

Environ Aspects of Cooling Tower Plumes, Paper, Aynsley, E., IITRI, Chgo, Ill, 10 p, 1970

Environ Aspects of Mercury Usage, Indexes, v I, II, & III, ist ed, The Dow Chem Co, Midland, Mich, 943 p, Aug 1970

The Environ Challenge of the 70's, Inst of Environ Sci, Tech Meet, 16th Annu, Proc, (Held in Boston, Mass, April 12-16, 1970), 522 p, 1970 Price: $14.00, $20.00 (non-members)

Environ Cost of Elec Power, Workbook, Abrahamson, D.F., Sci Inst for Public Info, NY city, 36 p, 1970, Proce: $1.00

Environ Design and Operation Criteria for Sanitary Landfills, Paper, Lambie, J.S., 4 p, 1970

Environ Design and Risk Criteria in Offshore Operations, A five-day program, Papers, (Held in San Francisco, Calif, Oct 12-16, 1970), Spon by Univ of Calif, Univ Extension, Continuing Education in Engr and Univ of Calif, College of Engr, Berkeley, 447 p, 1970

The Environ Dilema: Commitment for a Livable World, Hennigan, R.D., Paper, 9 p, 1970

Environ Engr: A Guide to Ind Pollut Control, Deskbook Issue, In: Chem Engr, NY, 77(9): 1-314, April 1970

Environ Health Prob, Rep, U.S. Dept of Health, Education and Welfare, Public Health Serv, Environ Health Serv, Rockvill, Md, 70 p, 1970

Environ Improvement (Air, Water, and Soil), Public Lecture Series, Marquis, R.W. (ed), (Held in Wash DC, May 1966), Spon by U.S. Dept of Agric, Graduate School, 112 p, Oct 1966

Environ Mercury Res In Sweden, Rep, Natl Swedish Environ Protection Board, Res Secretariat, Stockholm, 45 p, June 1970

Environ Mutagen Soc, Annu Meet, 1st, Program and Abstr, (Held in Wash DC, May 25-27, 1970), 36 p, 1970, Proce: $1.50

Environ Pollut--A Decade for Action, Conf, Sel Unbound Papers, (Held in NY, NY, May 25-27, 1970), Spon by Amer Mgt Assoc, Inc, 1970

Environ Pollut, Annotated Bibliography, Stern, M.S. and Stern, D.H., Univ of Miss, Dept of Bio, Kansas City, 19 p, 1970, Price, $0.25

Environ Pollut Instrumentation, Symp, Sel Papers, Chapman, R.L. (ed), (Held in Philadelphia, Pa, May 19-22, 1968), Spon by Instrument Soc of Amer, Analysis Instrumentation Div, Pittsburgh, Pa, 171 p, 1969

Environ Preservation, Symp, Papers, (Held in San Diego, Calif, May 20-21, 1970), Spon by U.S. Naval Undersea Res and Devel Centr, San Diego, Calif, In: U.S. Naval Undersae Res and Dev Centr, San Diego, Calif, Tech Paper TP215, 184 p, March 1971

Environ Quality Press Conf, Papers, (Held in Coeur D'Alene, Idaho, June 22, 1970), Spon by OUtdoor Writers Assoc of Amer, 120 p, 1970

Environ Radioactivity, Symp, Papers, Clopton, J.C.(ed), (Held in Baltimore, Md, Jan 19-20, 1970) Spon by Johns Hopkins Univ, Dept of Geography and Environ Engr, Graduate Student Symp Comm, Baltimore, Md, 277 p, Nov 1, 1970

Environ Requirements of Blue-Green Algae, Symp, Proc, (Held in Corvallis, Ore, Sept 23-24, 1966), Spon by Fed Water Pollut Contr Admin, NW Region, and Univ of Wash, Seattle, 114 p, 1967

Environ Sci Conf for State Supervisors of Sci, Papers, (Held in Portland, Ore, May 1-5, 1970), Spon by Natl Sci Foun, Wash DC, Portland State Univ, Ore: Ore State Dept of Education, Salem and Council of State Sci Supervisors, 106 p, 1970

Equip for the Working Diver, Symp, Proc, Landeman, D. (ed), (Held in Columbus, Ohio, Feb 24-25, 1970), Spon by U.S. Navy, Office of the Supervisor of Diving, Springfield, Va, Battelle Memorial Inst, Columbus Labs, Columbus, Ohio and Marine Tech Soc, Bellview, Wash, 478 p, 1970, Price: $8.00

Equilibriaum Concepts in Natural Water Systs, Symp, Meet, 151st, Papers, Gould, R.F. (ed), (Held in Pittsburgh, Pa, March 23-24, 1966), Spon by Amer Chem Soc, Div of Water, Air, and Waste Chem, Amer Chem Soc, Advances in Chem Series 67, Wash DC, 344 p, 1967, Price: $8.50

Escarosa: A Preliminary Study of Coastal Zone Mgt Probs and Opportunities In Escambia and Santa Rosa Counties, Fla, Fla Coastal Coordinating Council, Tallahassee, 35 p, April 1971

Etude Structurale Du Plateau Continental Au Large Des Cotes Meridionales De La Bretagne, France, Rep, Bouysse, Ph, and Horn, R., Bureau de Recherches Geologiques at Mineres, Paris, France, 24 p, 1969

Europaeische Abwassersymposium, Proc, (Held in Munich, Germany, Sept 1969), In: Abwassertechnische Vereinigung, Munich, Berichte 23, 347 p, 1969

European Conservation Conf, Themes, (Held in Strasbourg, France, Feb 9-12, 1970), Spon by Council of Europe, Strasbourg, France, 223 p, 1970

European Conservation Year 1970, Booklet, Council of Europe, Strasbourg, France, 33 p, 1970

Eutrophication-Biostimulation Assessment Workshop, Proc, Middlebrooks, E.J.; Maloney, T.E.; Powers, C.F. and Kaack, L.M. (eds), (Held in Berkeley, Calif, June 19-21, 1969), Spon by Univ of Calif, Sch of Public Health and College of Engr, Div of Hydraulic and Sanitary Engr, Sanitary Engr Res Lab, Berkeley, and U.S. Dept of the Interior, Fed Water Pollut Control Assoc, Pacific NW Water Lab, Natl Eutrophication Res Program, Corvallis, Ore, 280 p, 1969

Evaluation of Kraft Liquor Concentrator Operation, Paper, Groce, A.B.,Jr, and Harris, A.D., Jr, 18 p, Jan 1970

Evaluation Proc in Water Resourc Planning, Conf, Proc, Whipple, W.,Jr, Englebert, E.A., and Trock, W.L. (eds), (Held in Milwaukee, Wisc, June 14-19, 1970), Spon by Univ of Wisc, Milwaukee and Amer Water Resour Assoc, 160 p, 1970

Eutrophication: Causes, Consequences, Correctives, Intl Symp on Eutrophication, Proc, (Held in Madison, Wisc, June 11-15, 1967), Spon by Natl Academy of Sci -- Natl Res Council; U.S. Atomic Energy Comm; U.S. Dept of the Interior; Natl Sci Foun and U.S. Office of Naval Res, 666 p, 1969, Price: $13.50

Evaluating Risks of Pesticides to Fish, Paper, Alabaster, J.S., 8 p, 1969

Evaluating the Noises of Transp, Symp, Papers, Chalupnik, J.D. (ed), (Held in Seattle, Wash, March 26-28, 1969), Spon by U.S. Dept of Transp, Office of Noise Abatement, Wash, DC, Univ of Wash Press, Seattle, 374 p, 1970, Price: $14.50

Evaluations of Emissions and Control Tech in the Graphic Arts Ind, Final Tech Rep, Gadomski, R.R., David, M.P., and Blahut, G.A., Graphic Arts Tech Foun, Pittsburgh, Pa, 236 p, Aug 1970

An Evaluation of Recent Approaches for the Design of Bio Waste Treatment, Rep, Graves, Q.B., and Yu, T., Okla State Univ, Okla Water Resourc Res Council, Stillwater, 142 p, 1969

Evaluation Processes in Water Resourc Planning, Conf, Proc, Whipple, W., Jr, Engelbert, E.A. and Trock, W.L. (eds), (Held in Milwaukee, Wisc, June 14-19, 1970), Spon by Univ of Wisc, Milwaukee and Amer Water Resourc Assoc, Urbana, Ill, In: Amer Water Resourc Assoc, Urbana, Ill, Proc Series 10, 165 p, May 1971

Evidence Submitted by the Inst of Water Engr to the Central Advisory Comm, Rep, Inst of Water Engr, London, 42 p, Feb 1970

Exhaust Maniforl Thermal Reactors--A Solution to the Automotive Emissions Prob, Paper, Mikita, J.J. and Cantwell, E.N., 13 p, 1970

FAO, Intl Conf on Investment in Fisheries, (Held in Rome, Italy, Sept 18-24, 1969), Unbound Papers, 1969

Facteurs Biologiques D'Auto=Epuration, Colloque Intl D'Oceanographie Medicale, 4th, (Held in Naples, Italy, Oct 2-5, 1969), In: Revue Intl D'Oceanographie Medicale, 18-19: 29-270, 1970

Factors Affecting the Growth of Najas in Pickwick Reservoir, Martin, J.B., Bradford, B.N. and Kennedy, H.G., Tenn Valley Authority, Natl Fertilizer Devel Centr, Muscle Shoals, Ala, 47 p, 1970

Factors Affecting Wastewater, Eclamation and Recycle, Paper, Sack, W.A., 16 p, 1969

Farm Wastes, Paper, Wadleigh, C.H., U.S. Dept of Agric, Agric Res Serv, Beltsville, Md, 7 p, 1969

Farm Wastes, Symp, Papers, (Held in Newcastle Upon Tyne, Enland, Jan 7-8, 1970), Spon by Inst of Water Pollut Control, N Branch, Great Britain and Univ of Newcastle Upon Tyne, England, 99 p, 1970

Fed and State Action for Clean Waters, Paper, Mennigan, R.C., 23 p, 1969

Fed Expenditures on Res Devel, and Demonstration Related to Pollut for FY1969 and FY1970, Rep, Prepared by Fed Council on Sci and Tech, Res, Devel, and Demonstration Subcomm on Environ Quality, 13 p, 1970

Fed Power Comm Interests Environ Concerns Affecting the Elect Power and Natural Gas Ind, Rep, Fed Power Comm, Wash DC, 27 p, 1969

Fed Water Pollut Control Act, Oil Pollut Act, U.S. Dept of Interior, Fed Water Pollut Control Admin, Wash DC, 36 p, 1966

Federation of Scieties for Paint Tech, 49th Annu Meet and 36th Paint Show, Program, (Held in Detroit, Mich, Oct 27-30, 1971), 129 p, 1971

Fibrous Dust Seminar, Proc, (Held in Pittsburgh, Pa, Nov 22, 1968), Spon by Ind Hygiene Foun of Amer, Inc, Pittsburgh Pa, IN: Ind Hygiene Foun of Amer, Inc, Pittsburgh, Pa, Medical Series, Bull 16-70, 81 p, 1970

The Field Approach to Coastal Ecology: The Field Experience, V I, II, III, & IV, Taylor, B and Yeater, LW, Carteret County Public Schools, Regional Marine Sci Proj, Beaufort, NC, 154 p, 1969

Filtration Soc, London, Proc, Reprint, 1969

Fishery Sci and Related Courses in N.Amer Colleges and Univ, Catalogue, Martin, R.G., Sport Fishing Inst, Wash DC, 35 p, 1969

The Fitness of Man's Environ, Symp, Papers, (Held in Wash DC, Feb 16-18, 1967), Spon by the Smithsonian INst, Wash DC, Smithsonian Inst Press, Smithsonian Annual II, City of Wash, 250 p, 1968, Price: $5.95

Floating Atomic Power Plant Environ Prob, Paper, Le Menaute, B., 36p, 1969

Fla Rivers and Estuaries, Paper, Bader, R.G., 21 p, 1970

The Flow Properties of Solid Waste Slurries, Paper, Zandi, I. and Hayden, J.S., 24 p, 1970

Food and Agric Organ of the United Nations, European Inland Fisheries Advisory Comm, 6th Session, Symp, Rep, (Held in Krakow, Poland, May 18-22, 1970), 73 p, 1970

Food Processing Wastes, Natl Symp, 1st, Proc, (Held in Portland, Ore, April 6-8, 1970), Spon by U.S. Dept of the Interior, Fed Water Quality Admin, Pacific NW Water Lab, Corvallis, Ore; U.S. Dept of Agric, W Regional Res Lab, Albany, Calif; Natl Canners Assoc, Berkeley, Calif and NW Food Processors Assoc, Portland, Ore, IN: U.S. Dept of the Interior, Fed Water Quality Admin, Wash DC, Res Series 12060, 405 p, 1970, Price: $3.00

Food Processing Wastes, Natl Symp, 2nd, Proc, (Held in Denver, Colo, March 23-26, 1971), Co-Spon by U.S. EPA, Pacific NW Water Lab, Corvallis, Ore and Natl Canners Assoc, Berkeley, Calif, Ore State Univ, Dept of Printing Continuing Education Publ, Corvallis, 671 p, 1971

Forecasting the Landings of Brown Shrimp (Crangon Crangon) In the Netherlands, Paper, Boddexe, R., Intl Council for the Exploration of the Sea, Shellfish and Benthos Comm, 4 p, 1968

Freshwater Bio and Elect Power Generation, Part 2, Symp, Papers, (Held April 22, 1971), Spon by Central Elect Res Lab, Surrey, England, IN: Central Elect Res Lab, Surrey, England, Rep RD/L/M 321, 141 p, 1971

Further Review of Certain Persistent Organochlorine Pesticides Used In Great Britain, Rep by the Advisory Comm on Pesticides and Other Toxic Chem, Her Majesty's Stationery Office, London, 150 p, 1969, Price: 125 6D

The Fusion Torch: A New Approach to Pollut and Energy Usage, Paper, Eastlund, B.J., and Gough, W.C., 29 p, Nov 7, 1969

The Future of Instru in Water Pollut Cont, Paper, McDermott, J.H.; Ballinger, D.G. and Sayers, W.T., 10 p, 1968

FWPC Methods for Chem Analysis of Water and Wastes, Manual, U.S. Dept of the Interior, Fed Water Pollut Cont Admin, Div of Water Quality Res, Analytical Quality Cont Lab, Cincinnati, Ohio, 290 p, Nov 1969

Gas Generation and Movement in Landfills: Probs caused by Gas Produced in Sanitary Landfills, Paper, Anderson, D.R. and Callinan, J.P., Loyola Univ, College of Engr, Los Angeles, Calif, 15 p, 1970

The General and Comparative Bio of Toxic Metals and Their Derivatives: Mercury, Siegel, S.M.; Eshleman, A.; Umeno, I.; Puerner, N. and Smith, C.W., 34 p, 1971

Geol of Shelf Seas, Inter-Univ Geol Cong, 14th, Proc, Donovan, D.T. (ed), Oliver & Boyd, London, 165 p, 1968, Price: 845

Georgia Water Cont Act 870 (H.B. 730), State of Georgia, 24 p, 1966

German One-Boat Midwater Trawl (Devel Since 1959 to the beginning of 1968), Trans, Scaerfe, J., Natl Sci Foun, Special Foreign Currency Sci Info Program, 66 p, 1969, Price: $3.00

Global Ocean Floor Analysis and REs, Booklet, U.S. Naval Oceanographic Office, Wash DC, 34 p, 1969

Gold in Sea Water--Fact of Fancy, Paper, Rosebaum, J.B.; May, J.T. and Riley, J.M., U.D. Bureau of Mines, Salt Lake City Metall Res Centr, Utah 11 p, FEb 1969

Governor's Conf on Thermal Pollut, Papers, (Held in Traverse City, Mich, July 18, 1969), Spon by Mich Water Resourc Comm, Lansing, 83 p, 1969

Governor's Environ Quality Conf, Proc, Fite, R.C. (ed), (Held in Stillwater, Okla, Sept 24-25, 1970), Okla State Univ, Stillwater, 145 p, Nov 1970

The Great Lake as an Environ, Lecture Series, Anderson, D.V. (ed), In: Toronto, Univ, Great Lakes Inst, Rep PR39, 341 p, Oct 1969

The Greenland Halibut, A Round Flatfish or a Flat Roundfish? Paper, DeGroot, S.J., Intl Council for the Exploration of the Sea, Demersal Fish (Northern) Comm, 3 p, 1968

Growth, Survival, Food Habits, and Sexual Devel of Croaker, Micropogon Undulatus, In Brackish Water Ponds, Paper, Avault, J.W. Jr; Perry, W.G. Jr and Birdsong, C.L., 9 p, 1969, Price: $1.50

Guide for the Certification of Cargo Containers, Paper

Guide to the Appraisal and Cont of Air Pollut, Amer Public Health Assoc, Inc, NY, NY, 80 p, 1969, Price: $2.50

Guidelines for the Selection of Marine Materials, Rep, Tuthill, A.H. and Schillmoller, C.M., Into Nickel Co, Inc, NY city, 39 p, 1969

Gulf and Caribbean Fisheries Inst, Annu Session, 21st, Proc, Higman, J.B. (ed), (Held in Miami, Fla, Nov 1968), Univ of Miami, Inst of Marine Sci, Coral Gables, Fla, 190 p, June 1969

Handling Intl Cargo, Intl Conf, 9th, Proc, (Held in Gothenburg, Sweden, June 2-5, 1969), Spon by Intl Cargo Handling Co-Ordination Assoc, Gothenburg, Sweden, 143 p, 1969

Harbors, Heads, Horrors: A Discussion of the Prob of Shipboard Waste Mgt, Paper, Anderson, D.R., 6 p, 1971

Hawaii and the Sea: A Plan for State Action, Rep to the Gov Task Force on Oceanography, State of Hawaii, Dept of Planning and Economic Devel, 112 p, 1969

Hazardous Chem Handling and Disposal, Symp, 2nd, Proc, Howe, R.H.L. (ed), (Held in Indianapolis, Ind, April 20-22, 1971), Jointly Spon by Inst of Advanced Sanitation Res, Intl: Ind Public Health Assoc; Ind Academy of Gen Practice; Ind Assoc of Santiarians; Ind Assoc of Public Health Physicians; Amer Academy of Pediatrics, Ind State Chapter; Ind State Medical Assoc Comm of Voluntary Health Agencies; Ind State Vet Medical Assoc and Ind Assoc of Health Educators, Noves Data Corp, Park Ridge, NJ, 172 p, 1971, Price: $20.00

Hazardous Pollut Substancees Symp, Annex 1, To Study on Cont of Hazardous Pollut Substances, Proc, (Held in New Orleans, La, Sept 14-16, 1970), Spon by U.S. Coast Guard, Wash DC, 558 p, 1970

Health Physics Soc, Annu Meet, 16th, Abstr, (Held in NY, NY, July 11-15, 1971), 68 p, 1971

Hearing Before the Subcomm on Oceanography of the Comm on Merchant Marine and Fisheries, House of Repre, 91st Cong, 1st Session, U.S. Govt Printing Office, Wash, 202 p, 1969

The Heat Equation as a Model for Air Pollut, Paper

Heat Exchange Between the Atomsph and the Ocean, Symp, Paper, (Held in Kobe, Japan, Jan 21, 1969), Spon by Marine Meteor Soc; Oceanographical Soc of Japan and Global Atomosph Res Programme (GARP) Subcomm on Air-Sea Interaction, In: Umi to Sora, Kobe, Japan 45(2-3): 47-122, Dec 1969

The Helium Soc, Symp, Proc, Blizin, J.S. (ed), (Held in Wash DC, March 23-24, 1970), 431 p, 1970

High Density Compaction Processes for Solid Wastes, Paper, Carver, P.T., 22 p, 1970

The History of the Earth's Crust, Symp, Contrib, Phinney, R.A. (ed), (Held in NY NY, Nov -1-12, 1966), Spon by Columbia Univ, Dept of Geo, Palisades, NY and Goddard Inst for Space Studies, NY city, 244 p, 1968 Price: $13.50

The History of the World's Oceans, Conf, Abstr, (Held in Moscow, USSR, Dec 1969), Spon by Moscow Assoc of Res in the Natural Sci, USSR and Academy of Sci UDDR, Earch Sci Sect, Moscow, In: Oceanology, 9(5): 725-743, 1969

Hydrolab Surveyor Brochure, Hydroload Corp, Austin Tex, 10 p, 1970

Hydrology of the Coastal Waters of NC, Symp, Proc, (Held in Raleigh, NC, May 27, 1967), In: NC, Univ, State College of Agric and Engr, Raleigh, Water Resourc Res Inst, Rep 5, 154 p, 1967

Identifying Sea-Birds of the NW Atlantic Ocean, An Intro for Ships at Sea, Paper, Brown, R.G.B., Hills, E.L., Hills, A.H. and Pocklington, R., Dalhousi Univ, Inst of Oceanography, Halifax, Nova Scotia, Canada, 39 p, 1968

Impact of Air Pollut on Vegetation, Conf, Proc, (Held in Toronto, Canada, April 7-9, 1970), Spon by Air Pollut Cont Assoc, Ontario Sect and TR-7 Agric Comm and Ontario Dept of Energy and Resourc Mgt, Air Mgt Branch, Canada, k89 p, 1970

Impact of Waste Heat on Aquatic Ecology, Paper, Carlson, C.L., Cornell Univ, Conservation Dept, Ithaca, NY, 15 p, 1969

Implementing the Standards and Criteria Program of the Natl Air Pollut Cont Admin, Paper, Megonnell, W.M., 13 p, 1969

Index to Res on Coastal and Estuarine Waters in the U.S., Ditsworth, G.M.,

U.S. Dept of the Interior, Fed Water Pollut Cont Admin, NW Region, Corvallis, Ore, 36 p, Sept 1967

Ind Coal Conf, Sel and Unbound Papers (Held in Lexington, Hy, April 8-9, 1970), 1970

Ind Process Design for Water Pollut Cont, Workshop, Proc, (Held in San Francisco, Calif, March 31-April 2, 1970), Spon by Amer Inst of Chem Engr, Water Comm, NY city, 119 p, 1971

Ind Process Design for Water Pollut Contr, v II, Workship, Proc, (Held in Houston, Tex, April 24-25, 1970), Spon by Amer Inst of Chem Engr, Water Comm, NY city, 102 p, 1970, Price: $6.00, $12.00 (non-members)

Ind Waste and Pollut Cont Conf and Advanced Water Conf, 22nd & 3rd, Proc, (Held in Stillwater, Okla, March 29-30, 1971), Spon by Okla State Univ, Univ Ext, Stillwater, 210 p, 1971

Ind Waste Conf, Part 1, 23rd, Proc, (Held in Lafayette, Ind, May 7-9,1968), Spon by Purdue Univ, Lafayette, Ind and Ind State Board of Health, Indianapolis, IN: Purdue Univ, Lafayette, Ind, Engr Ext Series 132, 625 p, 1968, Price: $16.00

Ind Waste Guide on Thermal Pollut, Rep, U.D. Dept of the Interior, Fed Water Pollut Cont Assoc, NW Region, Pacific NW Water Lab, Corvallis, Ore, 118 p, Sept 1968

Ind Wastes and Salvage, v II, Pollut Incineration and Salvage, 2nd ed. Directory, Atlas Publ Co, NY NY, 213 p, 1971

Influence on Water Quality in Chesapeake Bay in Treatment Plant Design and Outfall Siting--A Case Study in Decision Making, Paper, Pritchard, D.W., 24 p

Info About...Recycling Resourc, New Raw Materials and Solid Waste, Rep, Natl Assoc of Secondary Material Ind, Inc, NY city, 12 p, Aug 1970

Initial Rep of the Deep Sea Drilling Proj,

The Inst and Its Tranditions, Address, Stanbridge, NH, Inst of Water Pollut Cont, Johannesburg, S. Africa, 28 p, April 1970

Inst of Public Cleansing, Annu Conf, 72nd, Proc, (Held in Torbay, England, June 1970), IN: Public Cleansing, 60(8): 361-468, Aug 1970

Inst of Water Pollut Cont, Annu Conf, Proc, (Held in Blackpool, England, Sept 8-11, 1970), IN: Water Pollut Control, 70(3): 243-337, 1971

Inst of Water Pollut Cont, S. African Branch, Biennial Conf, Proc, (Held in Cape Town, S. Africa, March 16-20, 1970), IN: Water Pollut Cont, 70(2): 123-240, 1971

Inst on Oil and Gas Law and Taxation, 20th Annu, Paper, 1969

Instream Aeration of Pollut Rivers, Rep, Whippke, W., Jr; Junter, J.V.; Davidson, B.; Dittman, F and Yu, S., Rutgers Univ, Water Resourc Res Inst, New Brunswick, NJ, 309 p, Aug 1969, Price: $2.00

Instru Soc of Amer, Annu Conf and Exhibit, Sele Preprints, (Held in Houston, Tex, Oct 27-30, 1969), IN: Instru Soc of Amer, Preprints 69-632, 69-637, 37 p, 1969, Price per Preprint: $1.00, $1.50 (non-members)

Instru in the Chem and Petro Ind--v 6, Instru Soc of Amer, Chem and Petro Instru Symp, 11th Annu, Proc, Bajek, W.A. (ed), (Held in Chgo, Ill, April 8-10, 1970), Instru Soc of Amer, Pittsburgh, Pa, 85 p, 1970

Instru in the Pulp and Paper Industry -- v II

Instru Soc of Amer, Pulp and Paper Instru Intl Symp, 11th, Proc, Johnson, R.K. (ed), Held in Greenville, SC, April 15-17, 1970, Instru Soc of Amer, Pittsburgh, Pa, 112 p, 1970

Insurance as a Regulation, Paper, 13 p, 1970

Interdisciplinary Res Topics in Urban Engr, Rep, Hafferty, W.M.; Hess, R.W. and McGregor, R.G. (eds), Amer Soc for Engr Education, Urban Engr Study Comm, Wash DC, 320 p, Oct 1969, Price: $5.00

Internal Waves in a Weak Sheer in the Presence of Rotation, Paper, Frankignoul, C.J., Paper, Intl Council for the Exploration of the Sea, 10 p, 1969

Intl and Interstate Regulation of Water Pollut, Conf, Proc, O'Malley, C. K. (ed), (Held in NY City, March 12-13, 1970), Spon by Columbia Univ School of Law, Intl Legal Res and Columbia Univ, School of Law Parker School of Foreign and Comparative Law, NY City, Columbia Univ, School of Law, Columbia J of Transl Law, NY, NY, 321 p, 1970

Intl Assoc of Ports and Harbors, 6th Conf, Proc, (Held in Melbourne, Victoria, Australia, March 3-8, 1969), 307 p, 1969, Price: $10.00

Intl Conf on Geophysics of the Earth and the Oceans, Abstr, (Held in Sydney, Austrailia, Jan 19-23, 1970), Spon by Australian Inst of Physics, New S. Wales Branch, 17 p, 1970

Intl Cong on Ind Waste Water, Unbound Papers, (Held in Stockholm, Sweden, Nov 2-6, 1970), Spon by Intl Cong on Ind Waste Water, Drottning Kristinas, Stockholm, Sweden, 1970

Intl Conf on Planktonic Microf-ssils, 1st, v 1, Proc, Bronniman, P. and Renz, H.H. (eds), (Held in Geneva, Switzerland, Sept 27-Oct 3, 1967), E.J. Brill, Leiden, 745 p, 1969, Price: GLD 500

Intl Cong of Parasitology, 2nd, Proc, Resumes, Part I, (Held in Wash DC, Sept 6-12, 1970), Spon by World Fed of Parasitologists, IN: J of Parasitology, 56(4): 1-389, Aug 1970.

Intl Cong of Hyperbaric Medicine, 4th, Program (Held in Sapporo, Japan, Sept 2-4, 1969), Spon by Sapporo Medical College, Dept of Thoracic and Cardiovascular Surgery, Japan, 88 p, 1969

Intl Legal Conf on Marine Pollut Damage, Final Act, Inter-Govt Maritime Consultative Organ, 48 p, 1969

Intl Marine and Shipping Conf, 15 Secs, Preprints, (Held in London, England, June 10-20, 1969), Spon by the Inst of Marine Engr, London, 1969

Intl Navigation Cong, 22nd, Section II: Ocean Navigation, 6 v, Rep, (Held in Paris, France, 1969), Spon by Permanent Intl Assoc of Navigation Cong, Brussels, Belgium, 1331 p, 1969

Intl Oceanology Conf, Sel Paper, 1969

Intl Tug Conf, 1st, Proc, Troup, K.D. (ed), (Held in Teddington, England, Oct 7-9, 1969), Spon by Ship & Boat Intl, Thomas Reed Publ Ltd, London, England, 387 p, 1970, Price: 10 pounds 10's

Intl Union of Geddesy and Geophysics, Gen Assembly, 15th, Sel Papers, IN: Amer Geophysical Union, Transac, 52(6): 225-425, June 1971

Intl Water Conser Exhibition, Conf, (Held in Jonkoping, Sweden, Sept 2-4, 1970) Spon by Natl Swedish Environ Protect Board, Stockholm and Council of Europe, 492 p, 1970

In the Matter of Pollut of Lake Mich and its Tributary Basin in the States of Wisc, Ill, Ind, and Mich, V I, II & III, Conf, 3rd Session, Proc, (Held in Chgo, Ill, Marcy 24-25, 1971), Spon by U.S. EPA, Water Quality Office, Wash DC, 1021 p, 1971

Intro to Antarctica, 1969 ed, Rep, U.S. Naval Support Force, Antarctica, History and Res Div, Wash DC, 56 p, July 1969, Price: $0.60

Into to World Data Centr A, Oceanography

Invest and Resourc of the Caribbean Sea and Adjacent Regions, Symp, Reps and Abstr of Papers, Saetersdale, G (ed), (Held in Willenstad, Curacao, Netherlands Antilles, Nov 18-26, 1968), Spon by United Nations Educational, Sci and Cultural Organ, Food and Agric Organ of the United Nations and World Meteorological Organiz, IN: FAO Fisheries Reps 71.1, 165 p, Dec, 1969

Invest of FAllout 137C's in Norway 1962-1967, Paper, Stromme, A, Statens Radiologisk-Fysike Lab, Oslo, Norway, 84 p, 1967

Invest: Mercury in Wash State, Rep, Lee, R.A., State of Wash, dept of Ecology, Olympia, 25 p, Jan 1971

Invest on Gynodinium Breve Toxins in Shellfish, Rep, Cummins, J.M. and Stevens, A.A., U.S. Public Health Serv, Environ Health Serv, Gulf Coast Water Hygiene Lab, Dauphin Island, Alabama, 85 p, March 1970

Invest in Pollut Cont for the 70's, Info Sheet, Merrill Lynch, Pierce, Fenner & Smith, Inc, Securities Res Div, NY City, 20 p, Jan 1970

ION Exchange in the Process Ind, Conf, Papers, (Held inLondon, England, July 16-18, 1969), Spon by Soc of Chem Ind, London, 454 p, 1970

Is There Evidence for an Assoc of Radioactive Fallout to Leukemia and Fetal Mortality in NY State? Paper, Creenwald, P. and Kinch, S, NY State Dept of Health, Albany, 25 p

Is Water Quality Enhancement Feasible? Specialty Conf, Unbound Papers, (Held in Wash DC, March 13, 1970), Spon by Amer Soc of Civil Engr, Sanitary Engr Div, NY City, 1970

Jet Noise Seminar, Minutes, (Held in Wash DC, Oct 8-9, 1969), Spon by Town of Hemptead, NY and City of Inglewood, Calif, 120 p, 1969

Joint Group of Experts on the Sci Aspects of Marine Pollut (GESAMP), 1st Session, Rep, (Held in London, England, March 17-21, 1969), Inter-Govt Maritime Consultative Organiz (IMCO): Food and Agric Organiz of the United Nations (FAO) United Nations Educational, Sci and Cultural Organiz, (UNESCO) and World Meteorological Organiz (WMO), 57 p, July 17, 1969

Joint Group of Experts on the Sci Aspects of Marine Pollut (GESAMP), 2nd Session, Rep, (Held in Paris, France, March 2-6, 1970), Inter-Govt Maritime Consultative Organiz (IMCO); Food and Agric Organiz of the United Nations (FAO); United Nations Educational, Sci and Cultural Organiz (UNESCO); World Meteorological Organiz (WMO); World Health Organiz (WHO) and Intl Atomic Energy Agency (IAEA), 69 p, June 20, 1970

Junk Auto Disposal and Clean Air Legislation, Paper, Consumer Protect and Enfiron Health Serv, Natl Air Pollut Cont Admin, Durham, NC, 14 p, 1970

Junk Car Disposal, Subcouncil Rep, Natl Ind Pollut Cont Council, Wash DC, 54 p, 1970, Price: $0.40

Lake and River Pollut: An annotated Bibliography, Sinha, E., Ocean Engr Info Serv, Ocean Engr Info Series 4, La Jolla, Calif, 92 p, 1971, Price: $15.00

Land-Use Probs in Ill, Amer Assoc for the Advance of Sci, Meet, 137th, Symp, Papers, (Held in Chgo, Ill, Dec 26-31, 1970), IN: Ill, State Geol Survey, Environ Geol Notes 46, 42 p, May 1971

Landesanstalt Fuer Immissions - Und Bodennutzungsschultz Des Landes Nordrehein-Westfalen, Booklet, 16 p

Large Scale and Long Term Water Protect Planning, Symp, Papers, (Held in Delft, Netherland, Oct 23-25, 1969), Spon by European Fed for the Protect of Waters (EFPW), Zurich and Nederlandse Vereniging Tegen Water-, Bodem-En Luchtverontreiniging, Delft, IN: European Fed for the Protect of Waters Zurich, Info Bull 17, 69 p, Sept 1970

Large-Scale Photo Assessment of Smog-Damaged Pines, Paper, Heller, R.C., 14 p, 1969

Law and the Coastal Margin, Wrokshop, Sel Papers, (Held in Oct 1968), Spon by Gulf Univ Res Corp, Houston, Tex, In: Tex A&M Univ, Sea Grant Program, Sea Grant Publ 108, 83 p, 1970

Law and the Municipal Ecology: Air, Water, Noise, Over-Population, Lewin, S.F.; Gordon, A.H.; and Hartelius, C.J., IN; Natl Inst of Municipal Law Officers, Wash DC, Res Rep 156, 258 p, 1970

The Law of the Sea: Natl Policy Recommendations, Law of the Sea Inst, Annu Conf, 4th, Proc, Alexander, L.M. (ed), Spon by Univ of Rhode Isl Graduate School of Oceanography, Dept of Geography, Kingston, RI, 539 p 1970, Price: $7.50

Laws of NC relating to Water and Air Resourc, NC Dept of Water and Air Resourc, 91 p, 1968

Laws of NC relating to Water and Air Resourc, NC Dept of Water and Air Resourc, 38 p, 1970

Laws Relating to Planning, Amer Inst of Planners, Mich Chapter, Exec Office of the Gov, Office of Planning Coordination, Legislative Serv Bureau, Publ 94, 398 p, 1968

Leaf Structure as Related to Absorption of Pesticides and Other Compounds, Hull, H.M., In: Residue Rev, 31: 1-155, 1970

Lectures on the Fluid Dyn of Air-Sea Interaction, A Short Course at the Von Karman Inst for Fluid Dyn, Briscoe, M.B.; Pesaresi, R.; Shonting, D.A.; Woods, J. and Wu, J. (Held in Rhode-St.-Genese, Belgium, Jan 26-30, 1970), 287 p, 1970

Legal Aspects of Junk Auto Disposal, Rep, N Va Regional Planning Comm, 40 p, July 1968

Legal Probs in Constructive Use of Fed-State Jurisdictional Limits, Annex, Wilkes, D., Rep of the Gov's Tech Comm on Narragansett Bay and the Coastal Zone of RI, 71 p, 1970

A Limnological Reconnaissance of an Impoundment Receiving Heavy Metals, with Emphasis on Diatoms and Fish, Paper, Benoit, R.J.; Cairns, J.,Jr, and Reimer, C.W., 31 p, 1968

List of Publ on Herring (Clupea Harengus L.) In the Years 1965, 1966, and 1967. Paper, Zijlstra, J.J., Intl Council for the Exploration of the Sea, 20 p, 1969
Lit Refs to Highways and Their Environ Considerations, Rep, U.S. Bureau of Public Roads, Office of Right-of-Way and eocation, Environ Devel Div, U.S. Dept of Transp, Fed Highway Admin, Wash DC, 92 p, July 1, 1969
Livestock Waste Mgt and Pollut Abatement, Intl Symp, Proc, (Held in Columbus, Ohio, April 19-22, 1971), Spon by Amer Soc of Agric Engr, St. Joseph, Mich and Ohio State Univ, Centr for Tomorrow, Columbus, 360 p, 1971
Living in Our Environ, Inst of Environ Sci, Tech Meet, 17th Annu, Proc, (Held in Los Angeles, Calif, April 26-30, 1971), 508 p, 1971
La. Looks at the 70's: The Corp and the Environ, Address, Cannon, D.W., 18 p, April 1970
Low Pollut Power Systs Devel, Conf, Summary of Proc, (Held in Eindhoven, Netherlands, Feb 23-25, 1971), Spon by N Atlantic Treaty Organiz, Comm on the Challenges of Modern Soc, U.S. EPA; Air Pollut Cont Office, Rockville, Md, 28 p, 1971
Luchtverontreiniging Door Stof, Zwavelodioxyde en Stikstofoxyden in de Westelijke Minjnstreek, Rapport, Merrman, P.G., 11 p

The Main Coast: Prospects and Perspectives, Symp, (Held in Brunswick, Maine, Oct 20-22, 1966), Spon by Bordoin College, Centr for Resourc Studies, Brunswick, 106 p, 1967
The Maine Coast: Time of Decision, Bowdoin College, Centr for Resourc Studies, Brunswick, Maine, 29 p, 1967
Maine Law Affecting Marine Resourc: Regulation of the Coast: Land and Water Uses, v III, Par Rep, Spon by Univ of Maine, School of Law, Portland and Natl Sci Foun, Office of Sea Grant Programs, Wash DC, 217 p, 1970
Maine Law Affecting Marine Resourc: Resourc from the Sea and Fed Limitations on State Cont, v IV, Part Rep, Spon by Univ of Maine, School of Law, Portland and Natl Sci Foun, Office of Sea Grant Programs, Wash DC, 288 p, 1970
Maine Law Affecting Marine Resourc: State Govt Organiz: Agencies Dealing with Marine Resourc; Part Rep, Univ of Maine, School of Law, Portland and Natl Sci Foun, Office of Sea Grant Programs, Wash DC, 164 p, 1969
Maine Law Affecting Marine Resources: State, Public and Private Rights, Privileges, and Powers, v II, Part Rep, Univ of Maine, School of Law, Portland and Natl Sci Foun, Office of Sea Grant Programs, Wash DC, 270 p, 1970
Maintaining Clean Water Syst with Chem Additives, Paper, Curtis, S.D. and Silverstein, R.M., Drew Chem Corp, Process Chem Div, Parsippany, NJ, 3 p, 1970
Maintenance of Effort, Remarks, Hennigan, R.D., 9 p, 1969

Man and His Environ: Interaction and Interdependence, Conf 1, Proc, Wang, J.Y. (ed), (Held in San Jose, Calif, 1969), Spon by Natl Sci Foun, Wash DC; Sierra Club, Loma Prieta Chapt; Santa Clara Valley Audobon Soc and San Jose State College, Environ Sci Inst, Calif, 178 p, 1969

Man and the Quality of His Environ, Western Resourc Conf, Papers, Flack, J.E. and Shipley, M.C. (eds), (Held in Boulder, Colo, July 5-7, 1967), Spon by Colo State Univ, Colo, Univ of Colo Press, Boulder, 229 p, 1968

Man in Cold Water, A Conf on Undersea Operations in the Canadian Environ, Proc, (Held in Montreal, Canada, May 12-13, 1969), Spon by McGill Univ, Montreal Canada and Dept of Ind, Trade and Commerce of Canada, Canadian Soc of Oceanology, Oceanology Series 1, Ottawa, Ontario, Canada, 52 p, Dec 1969, Price: $5.00

Man, Land, Williams College Centr for Environ Studies the 1st Two Years, Rep, Carney, W., Williams College, Centr for Environ Studies, Williamstown, Mass, 61 p, Dec 1969, Price: $2.00

Man's Control of the Environ to Determine His Survival...Or to Lay Waste His Planet, Collected Papers, Nease, J. (ed), Congr Quarterly, Wash DC, 95 p, Aug 1970, Price: $4.00

Man's Impact on the Global Environ: Assessment and Recommendations for Action, Rep of the Study of Critical Environ Problems, (Held in Williamstown, Mass, July 1970), Spon by Mass Inst of Tech, Cambridge, 340 p, 1970, Price: $2.95

Mgt of the Natural Environ of Europe, Declaration, Council of Europe, Strasbourg, France, 6 p, 1970

Mgt of Water in the Iron and Steel Ind, Iron and Steel Inst, Annu Gen Meet, Proc, (Held in London, England, May 6-7, 1970), IN: Iron and Steel Inst, London, Publ 128, 141 p, 1970, Price: 9.75 pounds

Mgt Presentation to Security Analysts, Meet, Papers, (Held in Chattanooga, Tenn, June 24-25, 1971), IN: Combustion Engr, Inc, Progress No 2: 1-64, 1971

Managing the Environ: 9 States Look for New Answers, Rep, Haskell, E.H.; Price, V.; Matthews, W.; Cook, R.; Davidson, J. and Booth, R., 598 p, 1971

Manpower and Training Needs for Air Pollut Control, Rep of the Secretary of Health, Education and Welfare to the Cong of the United States, Richardson, E.L., 50 p, Aug 7, 1970, Price: $0.25

Manual for Evaluating Public Drinking Water Supplies, U.S. Public Health Serv, Consumer Protect and Environ Health Serv, Environ Control Admin, Bureau of Water Hygiene, Cincinnati, Ohio, 70 p, 1969, Price: $0.40

Manual for Evaluating Public Drinking Water Supplies, A Manual of Practice Recommended by the Public Health Serv, U.S. Public Health Serv, Consumer Protect and Environ Health Serv, Environ Control Admin, Bureau of Water Hygiene, Cincinnati, Ohio, 70 p, 1969, Price: $0.65

Manual on Methods for Measuring Primary Production in Aquatic Environ Incl a Chapter on Bacteria, Vollenweider, R.A.; Talling, J.F. and Westlake, D.F. (eds), Blackwell Sci Publ, Intl Bio Programme Handbook 12, Oxford, 213 p, Price: 45S

Manual on Water, 3rd ed, Amer Soc for Testing and Materials, ASTM Spec Tech Publ 442, Philadelphia, Pa, 369 p, 1969, Price: $16.50

Marine Coatings Based on Polyurethanes, Paper, Kubitza, W., 4 p, 1970

Marine Devel in Japan, Rep, Interministerial Marine Sci and Tech Comm, Tokyo, Japan, 44 p, March 1970

Marine Ecology, A High School Course, Unit 1: INtro, Scarff, J.M. Carteret Public Schools, Regional Marine Sci Proj, Beaufort, N.C., 156 p, Aug 1969

Marine Environ--A Glossary--A Profile, Papers, Inst of Environ Sci, Mt. Prospect, Ill, 21 p, 1967, Price: $2.00, $3.50 (non-members)

Marine Pollut and Its Effects on Living Resourc and Fishing, Tech Conf, Rep, (Held in Rome, Italy, Dec 9-18, 1970), Spon by Food and Agric Organiz of the United Nations, Rome, Italy, IN: FAO Fisheries Rep 99, 191 p, June 1971

Marine Res--Fiscal Year 1968, A Catalog of Unclassified Marine Res Activities Spon During FY 1968 by Fed and Non-Fed Organiz, Exec Office of the President, Natl Council on Marine Resourc and Engr Devel, 744 p, July 1, 1969, Price: $5.50

Marine Sci Affairs--A Year of Broadened Participation, 3rd Rep of the President to the Cong on Marine Resourc and Engr Devel, U.S. Govt Printing Office, Wash DC, 250 p, Jan 1969, Price: $1.25

Marine Sci Affairs--Selecting Priority Programs, Annu Rep of the President to the Cong on Marine Resourc and Engr Devel, Together with the Rep of the Natl Council on Marine Resourc and Engr Devel, U.S. Govt Printing Office, Wash DC, 295 p, April 1970

Marine Tech 1970, v I, Conf and Exposition, 6th Annu, Prepr, (Held in Wash DC, June 29-July 1, 1970), Spon by Marine Tech Soc, Wash DC, 763 p, 1970, Price: $8.50

Marine Tech 1970, v II, Conf and Exposition, 6th Annu, Prepr, (Held in Wash DC, June 29-July 1, 1970), Spon by Marine Tech Soc, Wash DC, 806 p, 1970, Price: $8.50

Marine Tech Soc, Annu Meet, 7th, Prepr, (Held in Wash DC, Aug 16-18, 1971) 729 p, 1970, Price: $15.00

Maritime Navigation, Intl Symp, Papers, (Held in Sandejord, Norway, Sept 24-26, 1969), Spon by the Norwegian Soc of Professional Engr in Co-Operation with the Norwegian Shipowners' Assoc, 189 p, 1969

Maritime Transport, A Study of the Maritime Transport Comm, Organiz for Economic Cooperation and Devel, Paris, 147 p, 1969, Price: $3.25

Mass Integrated (SIC) Statewide and Regional Air Pollut Cont Program, Paper, Dallas, J.L., 5 p, Dec 1969

Math Model of the Columbia River from the Pacific Ocean to Bonnevile Dam, Part II, Input-Output and Initial Verification Procedures, Rep, Callaway, R.J. and Byram, K.V., U.S. EPA, Water Quality Office, NW Region, Pacific NW Water Lab, Corvallis, Ore, 135 p, Dec 1970

The Measurement of Dust Nuisance Emitted by Chimneys, Paper, Crosse, P.A.E; Lucas, D.H. and Snosill, W.L., 13 p, 1960

Mercury Contamination in the Natural Environ, Bibliography, Barnes, M.E. (ed), U.S. Dept of the Interior, Office of Library Sci, Wash DC, 39 p, July 1970

Measurement of Noise Pollut and Approaches to Solutions, Paper, Lyons, D.W. and McKee, E., 27 p, 1969

The Mercury Pollut Prob in Mich and the Lower Great Lakes Area, A Summary of Info and Action Programs, Mich Water Resourc Comm, Lansing, 12 p, May 1, 1970

Metallgesellschaft, Address, Wittgenstein, C., 12 p, 1969

Meteorology and Atomic Energy 1968, Slade, D.H. (ed), U.S. Atomic Energy Comm, Div of Tech Info, Oak Ridge, Tenn, 495 p, July 1968, Price: $3.00

Methods for Chem Analysis of Waters and Wastewaters, Manual, Traversy, W. J., Canadian Dept of Fisheries and Forestry, Inland Waters Branch, Water Quality Div, Ottawa, 174 p, 1971

Methods in Air Pollut and Ind Hygiene Studies, Conf, 10th, Agenda and Papers, (Held in San Francisco, Calif, Feb 19-21, 1969), Cospon by Calif State Dept of Public Health, Air and Ind Hygiene Lab, Berkeley and Calif State Air Resourc Board, Sacramento, 418 p, 1969

Methods in Air Pollut and Ind Hygiene Studies, Conf, 11th, Unbound Papers, (Held in Berkeley, Calif, March 30-April 1, 1970), Cospon by Calif State Dept of Public Health, Sacramento; Calif Air Resourc Board, Sacramento; Univ of Calif, Berkeley and U.S. Natl Air Pollut Cont Admin, Wash DC, 1970

Methods in Air Pollut and Ind Hygiene Studies, Conf, 12th, Proc, (Held in Los Angeles, Calif, April 6-8, 1971), Cospon by Calif Air Resourc Board, Sacramento; Univ of S Calif, Air Pollut Cont Inst, Los Angeles and Calif State Dept of Public Health, Sacramento, 260 p, 1971

Methods, MOdels & Instruments for Studies of Aquatic Pollut: An Annotated Bibliography, Sinha, E., Ocean Engr Info Serv, Ocean Engr Info Series v 5, La Jolla, Calif, 32 p, 1971, Price: $6.50

Methods of Detection, Measurement and Monitoring of Pollut in the Marine Environ, Seminar, Rep, (Held in Rome, Italy, Dec 1970), Spon by Food and Agric Organiz of the United Nations, Rome, Italy; United Nations Economic, Social and Cultural Organiz, Paris; Intl Atomic Energy Agency, Vienna; Sci Comm on Ocean Res and World Meteorological Organiz, Geneva. IN: FAO Fisheries Rep 99-Suppl I, 126 p, Aug 1970

Methods of Detection, Measurement and Monitoring of Pollut in the Marine Environ, Seminar Rep, (Held in Rome, Italy Dec 4-10, 1970), Spon by Food and Agric Organiz of the United Nations, Rome, Italy. IN: FAO Fisheries Rep 99 Suppl 1, 126 p, Aug 1971

Methods of Dredging and Long-Distance Meteral (SIC) Carrying in Japanese Civil Engr Proj, Rep, Rinkai Civil Engr Construc Co, Limited, Japan, 10 p, 1969

Methods of Estimating the Production of Aquatic Animals, Handbook and Papers, Winberg, G.G. (ed), IN: Canada. Fisheires Res Board, Translation Series FRB 1170-II, 220 p, 1968

Methods of Radiochem Analysis, World Health Organiz, Geneva, 163 p, 1966

Methylmercury Toxicity: A Probablistic Assessment, Paper, Spear, R.C. and Wei, E., 13 p, 1971

Microbiol Prob Relating to Cold Storage of Fish and Shellfish, Symp, Summaries, Kawabata, T.; Shimidu, U. and Yokozeki, M. (eds), (Held in Tokyo, Japan, April 5, 1969), IN: Japanese Soc of Sci Fisheries, Bull, 35(8): 837-841, Aug 1969

Microorganic Matter in Water, Symp, Amer Soc for Testing and Materials, Annu Meet, 71st, (Held in San Francisco, Calif, June 23-28, 1968), IN: Amer Soc for Testing and Materials, Philadelphia, Pa, Special Tech Publ 448, 129 p, 1969, Price: $7.40, $9.25 (non-members)

Mich's Water Pollut Cont Act, Summary, Water Resourc Comm, Mich, 2 p, Feb 1969

Mineral Waste Utilization Symp, 2nd, Proc, (Held in Chgo, Ill, March 18-19, 1970), Cospon by U.S. Bureau of Mines, Wash DC, and IITRI, Chgo Ill, 373 p, 1970, Price: $15.00

Mississippi River Possution Abatement, Paper, Mattei, P.F., 11 p, 1970

Mississippi Water Resourc Conf, Proc (Held in Jackson, Miss, April 11-12, 1967), Spon by Miss State Univ, Water Resourc Res Inst, State College, 154 p, 1967

Mississippi Water Resourc Conf, Proc, (Held in Jackson, Miss, April 9-10, 1968), Spon by Miss State Univ Water Resourc Res Inst, State College, 139 p, 1968

Mississippi Water Resourc Conf, Proc, (Held in Jackson, Miss, April 8-9, 1969), Spon by Miss State Univ, Water Resourc Res Inst, State College, 169 p. 1969

Mississippi Water Resourc Conf, 6th Proc, (Held in Vicksburg, Miss, April 13-14, 1971), Spon by Miss State Univ, Water Resourc Res Inst, State College, 86 p, 1971

Mississippi Water Resourc Conf, Proc, (Held in Jackson, Miss, April 14-15, 1970), Spon by Miss State Univ, Water Resourc Res Inst, State College, 191 p, 1970

Mixing of Water Supply Reservoirs for Quality Cont, A State-of-the-Art Paper, Symons, J.M.; Carswell, J.K. and Robeck, G.G., U.S. Public Hearlth Serv, Consumer Protect and Environ Health Serv, Environ Cont Admin, Bureau of Water Hygiene, 61 p, Nov 1969

Motor Veh Air Pollut Cont, Symp, Proc, (Held in London, England, Nov 25-26, 1968), Spon by British Tech Council for the Motor and Petro Ind; Inst of Petro and Inst of Mech Engr, Auto Div, IN: Inst of Mech Engr, London, Proc, 183 (3E): 1-212, 1969, Price: 5 pounds

Municipal Refuse Disposal, 3rd Ed, Public Admin Serv, Chgo, Ill, 552 p 1970

Natl and Intl Environ Monitoring Activities, Directory, Smithsonian Inst, Wash DC, 306 p, Oct 1970, Price: $10.00

Natl Assoc of Corrosion Engr, 35th Conf, Proc, (Held in Houston, Tex, March 10-14, 1969), 716 p, 1970

Natl Conf on Packaging Wastes, 1st Proc, (Held in San Francisco, Calif, Sept 22-24, 1969), Cospon by U.S. Public Health Serv, Bureau of Solid Waste Mgt and Packaging Ind, Advisory Comm, U.S. EPA, Wash DC, 255 p, 1971, Price: $2.00

Natl Estuary Study, v 1-7, U.S. Dept of the Interior, Fish and Wildlife Serv, Bureau of Sport Fisheries and Wildlife and Bureau of Commercial Fisheires, Wash DC, 1210 p, Jan 1971, Price per v: $1.75(I); $3.00(II); $4.75(III); $2.25(IV); $2.25(V); $2.00(VI); $1.50(VII)

Natl Exec Conf on Water Pollut Abatement, Unbound Papers, (Held in Wash DC, Oct 23-24, 1969), Spon by U.S. Dept of the Interior, Wash DC, 1969

Natl Ground Water Quality Symp, Proc, (Held in Denver, Colo, Aut 25-27, 1971), Jointly Spon by EPA, Wash DC and Natl Water Well Assoc, Columbus, Ohio, 35 p, 1971

Natl Incinerator Conf, 1970, Proc, (Held in Cincinnati, Ohio, May 17-20, 1970), Spon by Amer Soc of Mech Engr, NY, 336 p, 1970

Natl Marine Sci in Education, Conf, Proc, (Held in Santa Catalina Island, Calif, Oct 3-5, 1969), Spon by Orange County Dept of Education, Santa Ann, Calif; Calif State College, Fullerton and Univ of S Calif, Marine Bio Lab, Santa Catalina Isl, 48 p, 1970

Natl Pollut Cont and Exposition, Papers, (Held in San Francisco, Calif, April 1-3, 1970), Spon by Houston Jr Chamber of Commerce and United States Yaycees, 133 p, 1970

The Natl Shrimp Cong Story 1956 to 1965, Neblett, W.R., Ring Power Corp, Jacksonville, Fla and Diesel Engine Sales, Inc, St. Augustine, Fla, 19 p, 1966

Natl Spec Conf on Disinfection, Proc, (Held in Amherst, Mass, July 8-10, 1970), Spon by Amer Soc of Civil Engr, Sanitary Engr Div, NY City; Univ of Mass, Dept of Civil Engr, Environ Engr Program, Amherst and Univ of Mass, Water Resourc Res Centr, Amherst, Amer Soc of Civil Engr, NY, NY, 710 p, 1970, Price: $10.00

Natl Telemetering Conf, Record, (Held in Wash DC, April 22-24, 1969), IN: Inst of Elect and Electronic Engr, Inc, Publ 69 C 4-NTC, 335 p, 1969, Price: $17.50, $20.00 (non-members)

Natural Gas Fueled Veh: Exhaust Emissions and Operational Characteristics, Paper, McJones, R.W. and Corbeil, R.J., 23 p, 1970

The Natural History and Behavior of the Calif Sea Lion, Peterson, R.S. and Bartholomew, G.A., The Amer Soc of Mammalogists, Spec Publ 1, 79 p, 1967, Price: $3.50

Natural Resourc, Environ Mgt, and Agric Address, Guy, W.L., y p, 1969

Nature Conservation, Spec Sudy Reps--v II, Countryside Comm, Coastal Preservation and Devel, Great Britain, Her Majesty's Stationary Office, London, 114 p, 1969, Price: $5.85

Natural Gas Turbine and Diesel Propulsion Symp, Abstr, (Held in London, England, Oct 7, 1969), Spon by the Ministry of Defence, Great Britain, IN: Marine Engr and Naval Architect, London, 92(1124): 448-469, Nov 1969

Naval Nuclear Propulsion Program--1971, 1st Session, Hearing Before the Joint Comm on Atomic Energy, 92nd Cong of the United States

The Nero Devel Programme, v I & II, Final Reps, Bogaardt, M.; DeBruin, C.; Heyboer, R.J.; Van Den Berg, P.C.; and Van Den Bergh, J.W., In: Reactor Centrum Nedsrland, Petten, Final Rep 97, 818 p, May 1968, Price per v: $3.00

Netherlands Ship Model Basin Ship Handling and Mandeuvring Simulator, Info Meet, Papers, (Held in Wageningen, Netherlands, Oct 22, 1969 and NY, NY, Nov 7, 1969), in: Intl Shipbuilding Progress, Rotterdam, 17(185) 3-18, Jan 1970

Neturon Activation Analysis for the Determination of Mercury in Environ Samples, Paper, Filby, R.H.; Davis, A.I. and Shah, K.R., 14 p, 1971

A New Course in Marine Sci, Midyear Rep, Cohen, M., 4 p, Feb 1970

New Directions in Solid Wastes Processing, Proc of an Inst, Litsky, W.; Gunner, H.B., and Kreplick, R. (eds), (Held in Framingham, Mass, May 12-13, 1970), Spon by Univ of Mass, Tech Guidance Centr for Ind Environ

Cont; Assoc Ind of Mass; Mass Dept of Commerce and Devel; Mass Dept of Public Health; Mass Dept of Public Works and U.S. Bureau of Solid Waste Mgt, 205 p, 1970

The New England Coastal Zone Mgt Conf, Proc, Forste, R.H. (ed), (Held in Durham, NH, April 28-29, 1970), Spon by New England Council, Inc; New England Marine Resourc Info Program; S New England Centr for Continuing Education; New England River Basins Comm; New England Regional Comm; Natl Sci Foun, Office of Sea Grant College Programs, 162 p, Dec 1970

New Horizons for Chem and Ind in the 1990's, Symp, Proc, (Held in Lancaster, England, July 7-11, 1969), Spon by Soc of Chem Ind, London, 199 p, 1970

New Jersey, A Case in Noise Legislation, Paper, Soporowski, J.J., Jr, 6 p, 1969

New Jersey Municipal Noise Ordinance Surveys: A Rep, Soporowski, J.J., Jr, 3 p, 1968

A New Shrimp Sieve, Paper, Boddeke, R., Intl Council for the Exploration of the Sea, Gear and Behavior Comm, 3 p, 1968

NY (State) Dept of Environ Conservation, Albany, News Release

New Trends in the Purification of Effluents from Pulp Mfg, Paper, Ruzickova, D, 8 p, 1969

New Zealand Water Conf 1970, Spon by: New Zealand Inst of Engr, Wellington, In: New Zealand Engr, 25(4): 89-93, April 15, 1970

1969-1970 Saline Water Conversion Rep, Exec Summary, U.S. Dept of the Interior, Office of Saline Water, Wash DC, 28 p, 1970, Price: $0.75

The 1969 Summary Survey of the Personnel Inventory of Marine Tech, Chan, G.L., College of Marine Press, Kentfield, Calif, 16 p, March 1970

The 1970's Decade of Decision, Address, Mac Mullen, R.A., 11 p, 1970

Nitrate and Water Supply: Source and Cont, Sanitary Engr Conf, 12th, Proc, Snoeyink, V. and Griffin, V. (eds), (Held in Urbana, Ill, Feb 11-12, 1970), Spon by Univ of Ill, Dept of Civil Engr and Ill Dept of Public Health, Div of Sanitary Engr, In: Ill, Univ, Urbana, Bull, 68(2): 1-195, Aug 5, 1970

The Nitrogen Cycle in the Sea, Paper, Dugdale, R.C., 3 p, 1969

No Deposit--Do Return, Man and His Environ: A View Toward Survival, Natl Conf, 13th, Papers, Johnson, H.D. (ed), (Held in San Francisco, Calif, Nov 1969), Spon by United Nations Educational, Social and Cultural Organiz, U.S. Comm, Addison-Wesley Publ Co, Menlo Park, Calif, 351 p, 1970

Noise Pollut Conf, Proc, (Held in New Brunswick, NJ, May 22, 1968), Spon by Rutgers Univ, College of Agric and Environ Sci, Dept of Environ Sci, New Brunswick, NJ, 38 p, 1968

NE Regional Antipollut Conf, Annu, Proc, Spliesgarot, U. (ed), (Held in Kingston, R.I., July 22-25, 1969), 106 p, 1969, Price: $10.00

N Pacific Fur Seal Comm Rep on Investigations from 1964 to 1966, Headquarters for the Comm, Wash DC, 161 p, April 1969

Note on Spawning Potential, Larval Abundance and Recruitment in Doggerbank Herring, Paper, Zijlstra, J.J., Intl Council for the Exploration of the Sea, 1 p, 1968

Nuclear Power and the Environ, U.S. Atomic Energy Comm, Div of Tech Info, Wash DC, 30 p, 1969, Price: $0.50

Nutrient Removal from Wastewater by Physical--Chem Processes, Paper, Cohen, J.M., 50 p, March 1971

Nutrient Removal from Wastewater by Physical--Chem Processes, Paper, Cohen, J.M., 26 p, 1971

OECD at Work for Environ, Booklet, Organiz for Economic Cooperation and Devel, Info Serv, Paris, France, 32 p, Oct 1971

OECON, 1st Intl Offshore Exploration Conf, Middle East, Proc, (Held in Athens, Greece, Dec 4-6, 1968), 465 p, 1968, Price: $20.75

Observations on Alaskan Environ Policies, Influences, and Issues, Paper, Hickok, D.M., 46 p, Dec 1969

Observations on Marine Affairs in Alaska, Paper, Hickok, D.M. and Wunnicke, E.C., 50 p, Feb 1970

The Occurrence of Bothriocephalus Scorpii Muller (Cestoda) in Turrot and Brill from Dutch Coastal Waters, Paper, De Groot, S.J., Intl Council for the Exploration of the Sea, Demersal Fish (Northern) Comm, 4 p, 1969

The Ocean and the Investor, Annu Conf, Papers, (Held in Los Angeles, Calif, April 1968), Spon by Amer Soc for Oceanography, Pacific Western Region, 144 p, 1969

Ocean Engr, Conf, Proc, (Held in Wash DC, Sept 23-25, 1969), Spon by U.S. Naval Facilities Engr Command, Wash DC, 136 p, 1969

Ocean Engr Education, Workshop, Proc, Gaither, W.S. (ed), (Held in Newark, Del, Oct 21-22, 1968), Spon by Univ of Del, College of Engr, Dept of Civil Engr, Div of Tech Serv, Newark, 166 p, 1969, Price: $6.50

Ocean Outfall Design: Part I, Lit Review and Theoretical Devel, Rep, Baumgartner, O.J. and Trent, D.S., U.S. Dept of the Interior, Fed Water Quality Admin NW Region, Pacific NW Water Lab, Corvallis, Ore, 135 p, April 1970

Ocean-Space: Europe's New Frontier--Toward a Long-Range, Concerted Programme for Exploitting the Resourc of the Sea, Pamphlet, Reed, L., Bow Publ, Ltd, London, 60 p, 1969, Price: 6S

Ocean Temperature Measurements for Power Plant Design, Paper, Cheney, W. O., and Richards, G.V., 35 p, 1965

Oceanographic Activities of the San Diego Div of Naval Undersea Warfare Centr, Sept 1967-Sept 1968, Rep, 55 p, Oct 1968

Oceanography and the Continental Shelf Resourc of Alaska, Paper, Scott, W.H., 9 p, Dec 1969

Oceanography Curricula, Compilation, Natl Oceanography Assoc, Wash DC, 8 p, 1969

Oceanography and Marine Bio: An Annu Review, v 6, Barnes, H. (ed), Hafner Publ Co, NY, 563 p, 1968, Price: $22.00

Oceanography in S Africa -- 1970, Symp, Papers, (Held in Durban, S Africa Aug 4-6, 1970), Spon by S African Natl Comm for Oceanographic Res, Pretoria, 680 p, 1970

Odors: Their Detection, Measurement and Control, Air Pollut Cont Assoc, Mic-Atlantic States Sect, Semiannu Tech Conf, Proc, (Held in New Brunswick, NJ, May 13, 1970), 100 p, 1970

Offshore Mineral Resourc: A Challenge and an Opportunity, 2nd Rep of the Presidents Panel on Oil Spills, Exec Office of the Pres, Office of Sci and Tech, Wash DC, 18 p, 1969, Price: $0.30

Offshore Tech Conf, 2nd Annu, Prepr, v I, (Held in Houston, Tex, April 22-24, 1970), Spon by Amer Inst of Mining, Metallurgical, and Petro Engr; Amer Assoc of Petro Geologists; Amer Inst of Chem Engr; Amer Soc of Mech Engr; Amer Soc of Civil Engr, Inst of Elec and Electronic Engr; Marine Tech Soc; Soc of Exploration Geophysicists and Soc of Naval Architects and Marine Engr, 768 p, 1970

Offshore Tech Conf, 2nd Annu, Prepr, v II (Held in Houston, Tex, April 22-24, 1970), Spon by Amer Inst of Mining, Metallurgical and Petro Engr; Amer Assoc of Petro Geologists; Amer Inst of Chem Engr; Amer Soc of Mech Engr; Amer Soc of Civil Engrs; Inst of Elect and Electronic Engr; Marine Tech Soc; Soc of Exploration Geophysicists and Soc of Naval Architects and Marine Engr, 858 p, 1970

Offshore Tech Conf, 3rd Annu, Prepr, v I, (Held in Houston, Tex, April 19-21, 1971), Spon by Amer Inst of Mining, Metallurgical and Petro Engr; Soc of Mining Engr, Metallurgical Soc and Soc of Petro Engr; Amer Assoc of Petro Geologists; Amer Inst of Chem Engr; Amer Soc of Mech Engr; Amer Soc of Civil Engr; Inst of Elect and Electronic Engr; Marine Tech Soc; Soc of Exploration Geophysicists and Soc of Naval Architects and Marine Engr, 926 p, 1971

Offshore Tech Conf, 3rd Annu, Prepr, v II, (Held in Houston, Tex, April 19-21, 1971), Spon by Amer Inst of Mining, Metallurgical, and Petro Engr; Soc of Mining Engr, Metallurgical Soc and Soc of Petro Engr; Amer Assoc of Petro Geologists; Amer Inst of Chem Engr; Amer Soc of Mech Engr; Amer Soc of Civil Engr; Inst of Elect and Electronic Engr; Marine Tech Soc; Soc of Exploration Geophysicists and Soc of Naval Architects and Marine Engr, 928 p, 1971

Oil on the Sea, Symp, Proc, Hoult, D.P. (ed), (Held in Cambridge, Mass, May 16-1969), Spon by Mass Inst of Tech, Cambridge and Woods Hole Oceanographic Inst, Woods Hole, Mass, Plenum Press, NY, 119 p, 1969, Price: $8.75

Oil Pollut Defense Syst, Rep, Harding Pollut Cont Corp, West Hempstead, NY, 15 p

Oil Pollut in the Tay Estuary, 1968 Following the Tank Duchess Incident, Rep of the Tech Advisory Comm, Corp of the City of Dundee Publ Dept, Scotland, 27 p, 1968

Oil Pollut of the Sea, Intl Conf, Proc, Barclay-Smith, P. (ed), (Held in Rome, Italy, Oct 7-9, 1968), Spon by British Advisory Comm on Oil Pollut of the Sea; Italian Natl Comm on Oil Pollut of the Sea and Nordic Union for the Prevent of Oil Pollut of the Sea, Sweden, 413 p, 1968

Oil Spill Cont Survey for Onshore and Offshore Facilities, Rep, Amer Petro Inst, NY, Crossley Surveys, Inc, 376 p, March 1970

The Oil Spill Problem, 1st Rep of the Pres Panel on Oil Spills, Exec Office of the Pres, Office of Sci and Tech, Wash DC, 32 p, 1969, Price: $1.25

Oil Spill Reconnaissance Using Remote-Sensing Techniques, Paper, Terry, S.A.; Buckmeier, F.J. and Watson, J.A., Paper, 16 p, 1971

Okla Ind Waste Conf, 21st, Proc, (Held in Stillwater, Okal, March 30-31, 1970), Spon by Okla State Univ, School of Civil Engr, Engr and Ind Ext; Okla Water and Pollut Cont Assoc; Amer Water Works Assoc, SW Sect; Okla State Dept of Health; Water Pollut Cont Fed; Okla Water Resourc Board; Okla Wildlife Comm; Okla Municipal League; U.S. Fed Water Pollut Cont Admin and Okla Corp Comm, 122 p, 1970

Ontario Ind Waste Conf, 18th, Abstr, (Held in Niagara Falls, Ontario, Canada, June 13-16, 1971), Spon by Ontario Water Resourc Comm, Toronto, Canada, 19 p, 1971

On Sensory Evaluation of Odorous Air Pollut Intensities, Measurements of Odor Intensity in the Lab and in the Field with Special Ref to Effluents of Sulfate Pulp Factories, Rep, Lindvall, T., In: Nordisk Hygienisk Tidskrift, Stockholm, Suppl 2, 181 p, 1970

On the Condition of Herring Larvae in the Central and Sothern N Sea, Paper, Vilela, M.H. and Zijlstra, J.J., Intl Council for the Exploration of the Sea, 7 p, 1968

On the Formation of Internal Waves Caused by Tidal Flow Over a Bottom Irregularity, Rep, Mork, M., Univ of Bergen, Geophysical Inst, Norway, 30 p, 1968

On the Herring Larvae in the Dutch Waddensea 1967-1969, Paper, Postuma, K.H., Intl Council for the Exploration of the Sea, 7 p, 1969

On the Mackerel in the NE North Sea, Paper, Postuma, K.H., Intl Council for the Exploration of the Sea, Pelagic Fish (Northern) Comm, 13 p, 1969

On the Recruitment to the Downs Herring, Paper, Zijlstra, J.J. and Postuma, K.H., Intl Council for the Exploration of the Sea, 3 p, 1968

Organic/Inorganic Polymers--A New Treatment for Cooling Water Syst, Paper, Puckorius, P.R., 14 p, 1971

Organic Pesticides in the Environ, Symp, Papers, Gould, R.F. (ed), (Held in Atlantic City, NJ, Sept 13-15, 1965), Spon by Amer Chem Soc, Div of Water, Air and Waste Chem and Div of Agric and Food Chem, Pesticide Subdiv, Amer Chem Soc, Advances in Chem Series 60, Wash DC, 309 p, 1966 Price: $8.50

Organotin Antifoulants, Lecture, Freiman, A., 11 p. 1970

Our Environ Battles Water Pollut, Booklet, Renn, C.E., Lamotte Chem Prod Co, Chestertown, Md, 32 p, March 1969

Our Nation and the Sea: Recommendations in the Marine Sci Comm, Rep, Ocean Sci and Tech Advisory Comm, (OSTAC) and Natl Security Ind Assoc (NSIA), 40 p, Jan 1970

The Oxidation Ditch for Sanitary and Ind Waste Treatment, Paper, Wallace, A.R., Pumps & Softeners, Ltd, London, Canada, 23 p, Sept 29, 1967

Package Plant Criteria Devel, PartI: Extended Aeration, Rep, Natl Sanitation Foun, Ann Arbor, Mich, 56 p, Sept 1966

Package Sewage Treatment Plant Criteria Devel, Part II: Contact Stabilization, Rep, Natl Sanitation Foun, Ann Arbor, Mich, 29 p, June 1968

Packaging and Shipping of RAdioactive Materials, Symp Summary, Aldrich, L.K., III (ed), (Held in Fort Belvoir, Va, March 11-12, 1969), Spon by U.S. Aemy Engr Reactors Group, Fort Belvoir, Va, 72 p, March 12, 1969

Pan Amer Cong of Naval Engr and Maritime Transp, 2nd, (Held in Rio De Janeiro, Brazil, June 1-7, 1969), Spon by Pan-Amer Inst for Naval Engr, 880 p, 1969

Passenger Transp at Low Supersonic Speeds, Bradley, E.S.; Johnston, W.M.; and Von Keszycki, C.H., Lockheed-Georgia Co, Preliminary Design Organiz, Marietta, Ga, 11 p

Payette Lake Study 1967-1969, State of Idaho, Dept of Health, Environ Improve Div, Water Pollut Cont Sect, 22 p, May 1970

Perspective on the Regulation of Underground Injection of Wastewaters, Monograph, Cleary, E.J. and Warner, D.L., Ohio River Valley Water Sanitation Comm, Cincinnati, 115 p, Dec 1, 1969, Price: $3.00

Pesticide Chem, Intl Cong, 2nd, Abstr, (Held in Israel, Feb 1971), 151 p 1971

Pesticides, Workbook, Brodine, V. and Bradford, A. (eds), Sci Inst for Public Info, NY, NY, 24 p, 1970

Pesticides and Other Related Chem, Organiz for Economic Cooperation and Devel, Environ Comm, Ad Hoc Meet, Rep, (Held in Paris, France, Jan 27-29, 1971), 30 p, 1971

Pesticides and Their Relationship to Environ Health, Part I & II, Rep on the Secretarys Comm, U.S. Dept of Health, Education & Welfare, Wash DC, 677 p, Dec 1969, Price: $3.00

Pesticides and Their Relationship to Environ Health, Rep of the Secretary Comm, Parts I & II, U.S. Dept of Health, Education & Welfare, U.S. Govt Printing Office, Wash DC, 690 p, Dec 1969, Price: $3.00

Pesticides in Surface Waters of the United States. A 5-Year Summary 1964-1968, Lichtenberg, J.J.; Longbottom, J.E.; Eicheiberger, J.W.; and Dressman, R.C., U.S. Dept of the Interior, Fed Water Pollut Cont Admin, Div of Water Quality Res, Analytic Qualuty Cont Lab, Cincinnati, Ohio, 36 p, Sept 1969

Pesticides in the Soil: Ecology, Degradation & Movement, Intl Symp, Papers, (Held in East Lansing, Mich, Feb 25-27, 1970), Spon by Mich State Univ, Pesticide REs Centr, E Lansing, 144 p, 1970

Pesticides - New Facts, Old Problems: A Panel, New Devel in Forest Insect Problems, Paper, Moore, A.D., 1969

Pesticides--Where Are We Today? Symp, Annu Meet, 65th, Papers, (Held in Gainesville, Fla, June 1970), Spon by Amer Dairy Sci Asso, Drugs and Chem Comm and Inter-Soc Comm on Drugs and Chem, In: J of Dairy Sci, 54(5): 695-734, May 1971

Photo-Optical Instrumentation for the 70's, Tech Symp, 15th Annu, Proc, v III, (Held in Anaheim, Calif, Sept 14-17, 1970), Spon by the Soc of Photo-Optical Instrumentation Engr; U.S. Air Force Syst Command and U.S. Army Materiel Command, 583 p, 1971

Physical Processes in the Spread of Oil on A Water Surface, Paper, Fay, J.A., 5 p, 1971

Physics of Aerody Noise, Trans, Rimskiv-Korsakov, A.V. (ed), In: U.S. Natl Aeronau and Space Admin, Wash DC, Tech Trans F-538, 107 p, Nov 1969

Physiology, Environ, and Man, Symp, Sel Papers, Lee, D.H.K. and Hinard, D. (eds), (Held in Aug 1966), Spon by Natl Academy of Sci--Natl Res Council, Academic Press, Interdisciplinary Monograph Series, NY, 451 p, 1970

The Pine Creek and Mill River Watersheds Fairfield, Conn: An Ecological Guide to Open Space, Land Use, Rep, Beals, W. and Westover, R., Yale Univ, School of Forestry, New Haven, Conn, 78 p, 1971

Plan a Career in Pesticide Tech, Pamphlet, Ferris State College, Big Rapids, Mich, 4 p

Plastics and Ecology: Influence on Pollut, Flammability and Safety, Regional Tech Conf, Tech Papers, Whitney, A.; Rad, E,; Wickson, E. and Ringwood, R. (eds), (Held in Cherry Hill, NJ, Oct 27-28, 1970), Spon by Soc of Plastics Engr, Inc, Palisades Sect, 135 p, 1970

The Plastics Ind and Solid Waste Mgt, Position Statement, Soc of the Plastics Ind, Inc, NY City, 10 p, Sept 1970

Platforms and Veh of the Marine Physical Lab at the Scripps Inst of Oceanography Univ of Calif, San Diego, Pamphlet, 7 p

A Pledge & A Promise, Booklet, Anheuser-Busch, Inc, St. Louis, MO, 26 p

Plume Rise, Briggs, G.A., U.S. Atomic Energy Comm, Div of Tech Info, Oak Ridge, Tenn, 86 p, 1969, Price: $3.00

Policy of the NC Board of Water and Air Resourc Relating to the Protect of Environ Quality, Statement, State of NC, Dept of Water and Air Resourc, Raleigh, 4 p, Oct 13, 1970

Pollut: What it is ... What it Does ... What Can be Done About it, Series of Lectures, Maunder, W.J. and Foster, H.D. (eds), Univ of Victoria, Evening Div, Victoria, B.C., 114 p, 1969, Price: $1.50

Pollut Abatement in Fertilizer Plants, Paper, Barber, J.C., 6 p, 1969

Pollut and Economic Growth: An Ecosystem for Ind Design, Paper, Gordon, M, 19 p, 1970

Pollut and Livestock Feeding in MO, Paper, McNabb, C.G., 9 p, 1970

Pollut and Our Environ, Natl Conf, Background Papers and Proc, Devos, A.; Pearson, N.; Silveston, P.L. and Drynan, W.R. (eds), (Held in Montreal Canada, Oct 31-Nov 4, 1966), Spon by Canadian Council of Resourc Ministers, Harvest House, Montreal, 264 p, 1968, Price: $3.50

Pollut and the Human Environ, Seminar, Proc, (Held in Bombay, India, Aug 26-27, 1970), Spon by Bhabha Atomic Res Centr, Cost Working Group on Human Environ, Bombay, India, 589 p, 1971

Pollut by Pesticides, Some Not Very Well Calculated Risks and Some Alterations for Better Regulation., The Conservation Foun, Wash DC, 32 p, 1969, Price: $0.50

Pollut Control and Related Res in the United Kingdon, Paper, Downing, A. L., 17 p, 1968

Pollut Cont and the Marine Ind, Conf, Proc, Ives, J.S., Jr, (ed), (Held in New Orleans, La, April 1-3, 1971), Spon by Intl Assoc for Pollut Cont, Bethesda, Md, 231 p, 1971

Pollut Cont in Steelmaking: Fact or Fiction? Paper, Tihansky, D.P., In: Rand Corp, Rept Dept, Santa Monica, Calif, Publ P-4552, 6 p, Jan 1971, Price: $0.50

Pollut Cont: Now or Never, Tech Intl Cong, Sel Abstr, (Held in NY, NY, Nov 2-4, 1970), SpOn by Tech Instruments Corp, Tarrytown, NY, 18 p, 1970

Pollut of Lake Erie, Lake Ontario and the Intl Sect of the St Lawrence River, Rep, v I, Summary, Campbell, N.J.; Bruce, J.P.; Hendrickson, J.K.; Higgins, P.H.; Penderton, C., Jr.; Steggles, W.A. and Vallentyne, J.R. (eds), Intl Lake Erie Water Pollut Board and Intl Lake Ontario-St. Lawrence River Water Pollut Board, 327 p, 1969

Pollut of Lake Erie, Lake Ontario and the Intl Sect of the St. Lawrence River, Rep, v II, Lake Erie, Campbell, N.J.; Bruce, J.P.; Hendrickson, J.F.; Higgins, P.M.; Pemberton, C., Jr; Steggles, W.A. and Vallentyne, J.R. (eds), Intl Lake Erie Water Pollut Board and Intl Lake Ontario-St. Lawrence River Water Pollut Board, 327 p, 1969

Pollut of Lake Erie, Lake Ontario, and the Intl Sect of the St. Lawrence River, Rep, v III, Lake Erie, Campbell, N.J.; Bruce, J.P.; Hendrickson, J.F.; Higgins, P.M.; Pemberton, C., Jr; Steggles, W.A. and Vallentyne, J.R. (eds), Intl Lake Erie Water Pollut Board and Intl Lake Ontario-St. Lawrence River Water Pollut Board, 340 p, 1969

Pollut of the Interstate Waters of the Potomac River (Wash Metropolitan Area) District of Columbia-Maryland-Virginia, Conf, Proc, v I & II, (Held in Arlington, Va, Dec 8-9, 1970), Spon by U.S. EPA, Water Quality Office, Wash DC, 416 p, 1970

The Potomac: Partners in Progress, Rep, Interstate Comm on the Potomac River Basin, 33 p, 1971

Potato Waste Treatment, Symp, Proc, (Held in Corvallis, Ore, March 8, 1968), Cospon by U.S. Dept of the Interior Fed Water Pollut Cont Admin, NW Region, Pacific NW Water Lab, Corvallis, Ore and Univ of Idaho, Moscow, 91 p, 1969

The Potential Role of Radiation in Wastewater Treatment, Paper, Ballantine, D.S., 19 p, 1969

The Power Industry's Requirement for Cooling Towers, Paper, Crutchfield, H.C., 10 p, 1970

Practical Remote Sensing: The Use of a Thermal Mapper in Studies of Cooling Water Discharged from Operating Thermal Power Plants, Paper, Doyle, M.J., Jr, and Cartwright, V.W. ,14 p, 1969

The Practice of Water Pollut in Bio, Mackethun, K.M., U.S. Dept of the Interior, Fed Water Pollut Cont Admin, Div of Tech Support, Wash DC, 281 p, 1969, Price: $1.50

Preservation of Fish by Irradiation, Panel Proc, (Held in Vienna, Austria, Dec 15-19, 1969), Spon by Food and Agric Organiz of the United Nations, Rome Italy and Intl Atomic Energy Agency, Div of Atomic Energy in Food and Agric, Vienna, Austria, 167 p, 1970, Price: $5.00

The President's Message on Environ, Excerpts Relating to Solid Waste, Nixon, R.M., 4 p, Feb 10, 1970

Pressure Sewerage Syst: Summer Street Separation Study Area, Boston, Mass, Rep, Amer Soc of Civil Engr, Combined Sewer Separation Proj, NY City and Camp, Dresser & McKee, Consulting Engr, Boston Mass, 87 p, Sept 1968, Price: $0.65

Preventing Ind Pollut, Conf, Papers, (Held in London, England, June 22-23, 1971), 161 p, 1971

Prevention and Cont of Oil Spills, Joint Conf Proc, (Held in NY, NY, Dec 15-17, 1969), Cospon by Amer Petro Inst and U.S. Fed Water Pollut Cont Admin, Wash DC, In: Amer Petro Inst, Publ 4040, 345 p, 1969

Prevention of Air Pollut by Refinery Sulfur Plants, Paper, Beavon, D.K.; Ralph M. Parsons Co, Los Angeles, 16 p, 1971

Prevention of Air Pollut by Sulfur Plants, Paper, Beavon, D.K.; Ralph M. Parsons Co, Los Angeles, 13 p, 1970

A Primer on Agric Pollut, Individual Papers, In: J of Soil and Water Conservation, 26(2): 44-65, March-April 1971

A Primer on Air Pollut, 2nd ed, Mobil Oil Corp, NY, NY, 22 p, Spring 1970

A Primer on Water Quality, Wwenson, H.A. and Baldwin, H.L., U.S. Geo Survey, Wash DC, 30 p, 1965, Price: $0.30

Problem 1: Financing of Water Mgt Costs in Sweden, Paper, Hakerman, B. and Helmersson, B., 7 p, 1970

The Problem of Air Pollut, Paper, Murphy, R.P., 10 p, 1969

Program for the Devel of Sci and Tech for the Devel of the Ocean, Rep of the Marine Sci and Tech Council in Response to the Prime Ministers Request, 14 p, Oct 21, 1968

Problems Associated with the Use of Lagoons for Stabilizing Lead Mining Wastewaters, Paper, Jennett, J.C. and Wixson, B.G., 23 p, 1971

Problems in Disposal of Waste Heat from Steam-Elect Plants, Rep, Fed Power Comm, Bureau of Power, Wash DC, 58 p, 1969

Programming--Ultimate Tool for Echo-Sounding, Paper, Zabloudil, K.F., 18 p, Sept 1968

Progress in Environ Quality, Paper, Winter, T.C., Jr, 35 p, Aug 1971

Progress in the Chem of Fats and Other Lipids, v 10, part 4, Holman, R.T. (ed), Pergamon Press, Pergamon Progress Series, NY, 102 p, 1969

Progress of the NASA Res Relating to Noise Alleviation of Large Subsonic Jet Aircraft, Conf, Papers, (Held in Hampton, Va, Oct 8-10, 1968), Spon by U.S. Natl Aeronau and Space Admin, Office of Tech Utilization, Sci and Tech Info Div, Wash DC, In: U.S. Natl Aeronau and Space Admin, Wash DC, Spec Publ SP-189, 346 p, 1968, Price: $3.00

Progress Toward Achiving, The Wuater Quality Goals for Boston Harbor, Rep, New England River Basins Comm, Boston Harbor Coordinating Group, Boston 19 p, Oct 1970

Progress Toward Pollut-Free Cars, Booklet, Gen Motors Corp, Detroit, Mich, 16 p, Oct 1970

Projection and Distribution of Waste Thermal Energy, Paper, Greenfield, S.M., In: Rand Corp, Rep Dept, Santa Monica, Calif, Publ 4540, 6 p, Dec 1970, Price: $0.50

Properties and Products of Algae, Symp, Proc, Zajjc, J.E. (ed), (Held in NY city, Sept 7-12, 1969), Spon by Amer Chem Soc, Div of Microbial Chem and Tech, NY, Plenum Press, NY, 154 p, 1970, Price: $12.50

Proposed Ambient Air Standards for Air Quality Control Region 1, Okla, Rep, Okla State Dept of Health, Environ Health Serv, Air Pollut Cont Div, 12 p, Nov 2, 1970

Proposed Effluent Guidelines, MO Water Pollut Board, Jefferson City, 13 p, Jan 1971

Prospects for Breeding Ornamental Scotch Pines Resistant to Air Pollut, Paper, Gerhold, H.D. and Palpant, E.H., 3 p, 1968

The Prospects for Elect Trucks, Paper, Starkman, E.S., 15 p, 1967

The Protection of the Environ: The Fight Against Pollut, Presented to Parliment by the Secretary of State for Local Govt and Regional Planning, The Secretary of State for Scotland and the Secretary of State for Wales by Command of Her Majest, Her Majestys Stationery Office, London, 29 p, May 1970, Price: $0.60

Providing Quality Environ in Our Communities, Public Lecture Series, (Held in Wash DC, Nov-Dec 1967), Spon by U.S. Dept of Agric, Graduate School, 155 p, 1968, Price: $3.00

Public Policy and Air Pollut Cont, Paper, Middleton, J.T., U.S. Dept of Health, Education and Welfare, Public Health Serv, Consumer Protect and Environ Health Serv, Arlington, Va, 7 p, 1969

Public Health and Water Reclamation, Rep, Deaner, D.G., Calif State Dept of Public Health, Bureau of Sanitary Engr, Sacramento, 42 p, May 1970

Public Hearing Concerning the Classification of Streams Having Segments Heretofore Classified "E", Proc, Rep, (Held in Raleigh, NC, Jan 7, 1971) State of NC, Board of Water and Air Resourc, Raleigh, 99 p, March 1, 1971

Pulse Position Modulation Communication via the Underwater Acoustic Communication Channel, Paper, Ritter, S., 5 p, 1970

Radioactivity and A Proposed Power Plant on Cayuga Lake, Paper, Citizens Comm to Save Cayuga Lake, Ithaca, NY, 16 p, Nov 1968

Radionuclides in the Environ, Amer Chem Soc, Meet, 155th, Symp, Papers, Gould, R.F. (ed), (Held in San Francisco, Calif, April 1-3, 1968) Spon by Amer Chem Soc, Div of Nuclear Chem and Tech, Amer Chem Soc, Advances in Chem Series 93, Wash DC, 536 p, 1970, Price: $15.00

A Rational Program for Cont of Lead in Motor Gas, Rep, Calif State Air Resourc Board, Tech Advisory Comm, Sacramento, 17 p, March 12, 1970

Reaction by the Investment Community, Speech, Mayforth, F.R., 8 p, 1970

Ref Methods for Marine Radioactivity Studies, Intl Atomic Energy Agency, Tech Rep Series 118, Vienna, 290 p, 1970, Price: $7.00

Recent Changes in Growth and Fecundity in the Common Sole in the Eastern North Sea, Paper, De Veen, J.F., Intl Council for the Exploration of the Sea, 9 p, 1969

Reclamation of Maine's Bying Lakes, Workshop-Conf, Proc, (Held in Bangor, Maine, March 24-25, 1971), Spon by Univ of Maine, Water Resourc Centr, Bangor; Depositors Trust Co; Cobbosseecontee Yacht Club; Central Maine Power Co and Maine State Planning Office, In: Maine, Univ, Water Resourc Centr, Bangor, Conf Rep 2, 117 p, June 1971

Recommendations for the Disposal of Ind Effluent Waters, Booklet, Inst for Ind Res and Standards, Dublin, 15 p, 1o70, Price: 8D

Recommended Procedures for Measuring the Productivity of Plankton Standing Stock and Related Oceanic Properties, Rep, Natl Res Council, Div of Earth Sci, Comm on Oceanography, Bio Methods Panel Natl Academy of Sci, Wash DC, 66 p, 1969, Price: $3.25

Recording the World Beneath the Sea, Appl Notes: For Multiple Use of OSR-Records, Aabloudil, K.F., 1969

Recycling Day in New York, Conf, Proc, (Held in NY, NY, Feb 2, 1971), Spon by New York Board of Trades Natl Business Council on Environ and Natl Assoc of Secondary Materials Ind, Inc, 118 p, 1971

Refuse Disposal for the Small Community, Booklet, Colo Dept of Health, Denver, 9 p, Sept 1968

The Regional Marine Sci Proj of the Carteret County, NC, Public Schools, Rep, Hon, W., Carteret County Public Schools, Beaufort, NC, 31 p, 1970

The Regional Marine Sci Proj of the Carteret County, NC, Public Schools A 3-Year Summary, 1967-1970, Carteret County Public Schools, Beaufort, NC, 7 p, 1970

A Regulation Relating to Water Quality Standards for Intrastate Waters of the State of Wash and a Plan for Implementation and Enforcement of Such Standards, State of Wash, Water Pollut Cont Comm, 27 p, Jan 8, 1970

A Regulation Relating to Water Quality Standards for Interstate and Coastal Waters of the State of Wash and a Plan for Implementation and Inforcement of Such Standards, State of Wash, Water Pollut Cont Comm, 25 p, Dec 4, 1967

Regulations and Emission Cont Standards for Suspended Particulates and Sulfur Oxides, Proposed for Adoption by Board of Water and Air Resourc, Dept of Water and Air Resourc, Raleigh, NC, 12 p

Regulations for the Cont of Air Pollut in the Metropolitan Boston Air Pollut Cont District, Commonwealth of Mass, Dept of Public Health Div of Environ Health, Bureau of Air Use Mgt, Boston, 21 p, July 1, 1970

Regulations Governing Water Pollut Cont in New Mexico, Excerpt, Water Quality Cont Comm, Santa Fe, New Mexico, 3 p

Die Reinigung von Abwaessern Aus Schlachthoefen und Krankenhaeusern, Liebmann, H. (ed), Verlag R. Oldenbourg, Munich, 258 p, 1970, Price: DM 98

Relationship of Agric to Soil and Water Pollut, Conf on Agric Waste Mgt, Papers, (Held in Rochester, NY, Jan 19-21, 1970), Spon by NY State College of Agric, Statutory College of the State Univ, At Cornell Univ, Ithaca, NY, 274 p, 1970

Remote Sensing of Environ, v I, II, & III, Intl Symp, 6th, Proc and Summers, (Held in Ann Arbor, Mich, Oct 13-16, 1969), Spon by Univ of Mich, Inst of Sci and Tech, Centr for Remote Sensing Info and Analysis, Willow Run Lab, Ann Arbor, U.S. Geo Survey, Wash DC; U.S. Dept of Agric, Agric Res Serv, Wash DC; U.S. Environ Sci Serv Admin, Wash DC; and U.S. Coast Guard, Wash DC, 1558 p, 1969, Price: $15.00

The Removal of Carbonaceos Phosphatic, and Nitrogenous Pollut by Bio Treatment, Paper, Tenney, M.W.; Echelberger, W.F.; Guter, K.J. and Carberry, J.B., 40 p, 1971

Removal of Sulfur and Nitrogen Oxides from Stack Gases by Ammonia, Paper, Shale, C.C.; Simpson, D.G. and Lewis, P.S., 20 p, 1969, Price: $0.75

Renovated Waste Water: An Alternative Source of Municipal Water Supply in the United States, Johnson, J.F., Univ of Chgo, Dept of Geography, Research Paper 135, Ill, 163 p, 1971, Price: $4.50

Rep on Marine Sci and Tech, Presented to Parliament by the Lord Pres of the Council by Command of Her Majesty, Her Majestys Stationery Office, London, 55 p, April 1969, Price: $1.10

A Rep on Operating Experience with Multiple Hearth Injection at Nut Isl Sewage Treatment Plant, The Commonwealth of Mass, Metropolitan District Comm, Paper, Jones, R.A., 7 p, 1970

Rep on Status of Fed Gegu on Cont of Hazardous Materials Sect 1501.57, 1502.57, and 1503.57: Safety and Health Regulations for Shipyards, La Rocca, J.J., U.S. Dept of Labor, Bureau of Labor Standards, Office of Evaluation, Wash DC, 5 p, 1970

Rep on the Intl Trawling Survey for Immature Herring in the North Sea, 1968 Paper, Postuma, K.H., Intl Council for the Exploration of the Sea, Pelagic Fish (Northern) Comm, 3 p, 1968

Rep of the Swedish Deep-Sea Expedition 1947-1948, Table of Contents, 10 v, Petterson, H.; Kullenberg, B; and Jerlov, N.G. (eds), Swedish Natural Sci Res Council, Editorial Serv, Stockholm, Royal Soc of Arts and Sci, Gothenburg, Sweden, 1969, Price: $145

Res in Coastal and Ocean Engr, Paper, Herbich, J.B., 40 p, 1970

Res in Environ Quality Cont, Booklet, Battelle Memorial Inst, Columbus Labs, Columbus, Ohio, 35 p, 1968

Res on Wave Action, Symp, Proc, v I, Held in Delft, Netherlands, March 24-26, 1969, Spon by Delft Hydraulics Lab, Netherlands, 149 p, 1969

Res on Wave Action, Symp, Proc, v II, (Held in Delft, Netherlands, March 24-26, 1969), Spon by Delft Hydraulics Lab, Netherlands, 118 p, 1969

Res on Wave Action, Symp, Proc, v III, (Held in Delft, Netherlands, March 24-26, 1969), Spon by Delft Hydraulics Lab, Netherlands, 95 p, 1969

Res on Wave Action, Symp, Proc, v IV, (Held in Delft, Netherlands, March 24-26, 1969), Spon by Delft Hydraulics Lab, Netherlands, 1969

Reservoirs: Problems and Conflicts, Seminar, (Held in Corvallis, Ore, Fall 1968), Spon by Ore State Univ, Water Resourc Res Inst, Corvallis, 131 p, Jan 1969

Resourc and Man. A Study and Recommendations by Natl Academy of Sci -- Natl Res Council, Div of Earth Sci, Comm on Resourc and Man, Wash DC, W. H. Freeman and Co, San Francisco, 259 p, 169, Price: $5.95

Reuse and REcycle of Wastes, NE Regional Antipollut Conf, 3rd Annu, Proc, (Held in Kingston, R.I., July 21-23, 1970), Technomic Publ Co, Inc, Stanford, Conn, 247 p, 1971

Review of Analytical Methods for the Determination of Pollut in Indoor Air, Atmospheric Air and In Water, Booklet, Res Inst for Public Health Engr, Delft, Netherlands, 15 p, June 1970

Revitalizing Water the Natural Way, Paper, Hinde, J.N., 18 p, 1970

A River and a Nuclear Power Plant, Rep, Judd, P.H., NE Utilities Serv Co, 30 p, 1970

Role of Fed Govt in the Cont of Toxic Substances, Paper, Winter, T.C., Jr, 30 p, Aug 1971

The Role of Ind in Pollut Cont, Conf, Proc, (Held in East Brunswick, NJ, Sept 23-24, 1970), Spon by Amer Inst of Plant Engr, Holmdel, NJ, 43 p, 1970

The Role of Man in Navigation, Inst of Navigation, Annu Meet, Proc, (Held in Colo Springs, Colo, July 1-3, 1970), 549 p, 1970

The Role of the Local Health Dept in Solid Waste Disposal, Paper, Mafrici, D., 7 p, 1970

The Role of the State Legislature in Air Pollut Abatement, Paper, Zimmerman, J.F., 34 p, 1970

The Role , Sources and Cont of Nitrogen Oxides in Air Pollut, Paper, Peters, M.S., 34 p, 1968

Routine Dust Measurement Methods Devel at C.E.R.L., Paper, Lucas, D.H. and Snowsill, W.L., 15 p, 1968

Routine Surveillance for Radionuclides in Air and Water, World Health Organiz, Geneva, 60 p, 1968, Price: $2.75

Rules and Regulations Governing the Cont of Air Pollut, Rep, Dept of Water and Air Resourc, Board of Water and Air Resourc, Raleigh, NC, 27 p, 1971

Rules for Building and Classing Offshore Mobile Drilling Units, Amer Bureau of Shipping, NY, NY, 72 p, 1968, Price: $5.00

Rules of the Geo Water Quality Cont Board, Chapt 730, State of Geo, 34 p, 1970

Rules, Regulations, Classifications and Water Quality Standards Appl to the Surface Waters of NC, State of NC, Board of Water and Air Resourc, Dept of Water and Air Resourc, Raleigh, NC, 19 p, 1970

Safe Use of Pesticides, A Mannual for Public Health Personnel, Amer Public Health Assoc, Comm on Environ Health, Subcomm on Pesticides of the Program Area Comm, NY city, 103 p, 1967, Price: $3.00

Safety in the Use of Airless Spraying Equip, Paper, Pitt, F.R., 9 p, 1970

Saline Water--A Valuable Resourc, Amer Geophysical Union, Annu Meet, 15th, Symp, Papers, (Held in Wash DC, April 24, 1969), Spon by Amer Geophysical Union, Groundwater Comm, Sect of Hydrology, In: Water Resourc Res, 6(5): 1441-1531, Oct 1970

Sanitary Landfill Bull, Booklet, Gahr, W.N., Colo Dept of Health, Denver, 15 p, Aug 1969

Sanitary Landfill Location Study, Rep, Stark County Regional Planning Commission, Canton, Ohio, 96 p, Sept 1969, Price: $0.65

Sci and Tech and its Appl to the Problems of Pollut, Transp and Employment, Western States Conf, Public Sci Policy: Background Reading (Held in Salt Lake City, Utah, March 9-11, 1970), Spon by Fed of Rocky Mt States, Inc, Denver, Colo and Western Governors Conf, Denver, 41 p, 1970

Sci and the Environ--I, Symp, Proc, (Held in Wash DC, Jan 21, 1971), Spon by Wash Academy of Sci, Wash DC and Amer Ordnance Assoc, In: Wash Academy of Sci, Wash DC, J, 61(2): 54-147, June 1971

Sci and the Sea, v II, U.S. Naval Oceanographic Office, Wash DC, 85 p, 1969, Price: $0.75

Sci News Yearbook 1970, Sci Serv, Inc (eds), Charles Scribner's Sons, NY, 373 p, 1970, Price: $9.95

Sci Fundamentals of the Eutrophication of Lakes and Flowing Waters, and Particular Ref to Nitrogen and Phosphorus as Factors in Eutrophication, Bibliography, Organiz for Economic Cooperation and Devel, Paris, 61 p, Sept 1970

Sci Fundamentals of the Eutrophication of Lakes and Flowing Waters, with Particular Ref to Nitrogen and Phosporous as Factors in Eutrophication, Rep, Vollenweider, R.A., Organiz for Economic Cooperation and Devel, Pans, 254 p, Sept 1970

The Sea and Its Boundaries, Teacher Unit, Chapman, F.L., Carteret County Public Schools, Beaufort, NC, 13 p, 1970

The Sea and Modern Man, Teacher Unit, Chapman, F.L., Carteret County Public Schools, Beaufort, NC, 38 p, 1970

Sea Clutter Measurements by a 4-Frequency Radar, Paper, Laing, M.B., 8 p, 1969

Sea Flavor, Programs About Coastal Resourc for Your Civil Club, Directory, Regional Marine Sci Proj, Carteret County Public Schools, 12 p, Feb 1970

Sea Floor Spreading and Deep Sea Drilling, Von Herzen, R.P. and Maxwell, A.E., Paper, 7 p, 1969

Seawater Encroachment in Hawaiian Ghyben-Herzberg Syst, Paper, Lau, L.S., 13 p, 1967

Sedimentation: Annotated Bibliography of Foreigh Lit for 1967 and 1968, Survey 5, Natl Sci Foun, Spec Foreigh Currency Sci Info Program, Wash DC, 400 p, 1969, Price: $3.00

A Selected Bibliography on Public Environ Policy and Admin, Henning, D.H., Univ of New Mexico, Law School, Alburquerque, 15 p, 1970

Selected Refs on the Geology of the Gulf of Alaska Tertiary Province and Neighboring Areas, Alaska, Bibliography, Flafker, G. and Cobb, E.H., U.S. Geol Survey, Alaskan Geol Branch, Menlo Park, Calif, 10 p, May 1969

Seminar on Environ Arts and Sci, 3rd Session, Proc, Summary, (Held in Aspen, Colo, June 27-July 2, 1969), Spon by Thorne Ecological Foun, Boulder, Colo, 32 p, 1970

Sensing of of Environ Pollut, Joint Conf, Unbound Papers, (Held in Palo Alto, Calif, Nov 8-10, 1971), Spon by Amer Chem Soc; Amer Inst of Aero and Astro; U.S. EPA; Inst of Elect and Electronic Engr; Instrument Soc of Amer; U.S. Natl Aero and Space Admin and U.S. Natl Oceanographic and Atmosph Admin, In: AIAA Papers 71-1029, 71-1036, 71-1039, 71-1041, 71-1057, 71-1059, 71-1064, 71-1066, 71-1069, 71-1071, 71-1073, 71-1075 71-1078, 71-1079, 71-1081, 71-1083, 71-1088, 71-1098, 71-1101, 71-1103, 71-1104, 71-1106, 71-1108, 71-1116, 71-1119, 71-1121, 71-1124, 71-1126, and 71-1128, 1971, Price per Paper: $1.50, $2.00 (non-members)

Serum Esterases in Mackerel, Scomber Scombrus, L., Paper, Jamieson, A.; De Ligny, W. and Naevdal, G., Intl Council for the Exploration of the Sea, 16 p, 1969.

Seven-City Study of Air and Population Lead Levels, Interim Rep, Tepper, L.B., 11 p, May 1971

Sewerage and Sewage Treatment: State of the Art Abstr, Stone, R. (ed), Amer Soc of Civil Engr, Comm on Sewerage and Sewage Treatment, In: Amer Soc of Civil Engr, Sanitary Engr Div, J, 96(SA1): 35-48, Feb 1970

Ship Model Testing, Phillips-Birt, D. John De Graff Inc, Tuckahoe, NY, 95 p, 1970

Simulation--Decision Aid in Planning Desalting Appl, Paper, Westrope, J. S., 27 p, 1969

Sludge Accumulation and its Bio Significance in the Vicinity of a Marine Wastewater Outfall, Paper, Chen, C.W. and Orlob, G.T., 25 p, 1971

Soc of Auto Engr, Air Transp Meet, Sel Papers, (Held in NY, NY, April 29-May 2, 1968), In: Soc of Auto Engr, Inc, NY, Papers 680339, 680345-680348, 58 p, 1968

Soc of Auto Engr, Auto Engr Cong, Sel Papers, (Held in Detroit, Mich, Jan 8-12, 1968), In: Soc of Auto Engr, Inc, NY, Papers 680081, 680108-680110, 680113 and 680123, 87 p, 1968

Soc of Auto Engr, Auto Engr Cong, (Held in Detroit, Mich, Jan 12-16, 1970) In: Soc of Auto Engr, Papers 700074, 700078, 70010, 700105-700108, 700145-700147, 161 p, 1970

Soc of Auto Engr, Auto Engr Cong, Sel Papers, (Held in Detroit, Mich, Jan 12-16, 1970), In: Soc of Auto Engrs Inc, NY, Papers 700109, 700149, and 700151, 40 p, 1970

Soc of Auto Engr, Auto Engr Cong, Sel Reprints, (Held in Detroit, Mich, Jan 11-15, 1971), In: Soc of Auto Engr Inc, NY, Reprints 710009, 710011, 710060-710062, 710069-710072, 710075, 142 p, 1971

Soc of Auto Engr, Auto Engr Cong, Sel Papers, (Held in Detroit, Mich, Jan 11-15, 1971), In: Soc of Auto Engr In, NY, Papers 710010, 710012, 710014, and 710219, 63 p, 1971

Soc of Auto Engr, Central Ill Sect, Earthmoving Ind Conf, Sel Papers, (Held in Peoria, Ill, April 14-15, 1970), In: Soc of Auto Engr, Inc, NY, Papers 700551 and 700552, 15 p, 1970

Soc of Auto Engr, Combined Natl Farm, Construc and Ind Machinéry and Powerplant Meet, Sel Papers, (Held in Milwaukee, Wisc, Sept 14-17, 1970) In: Soc of Auto Engr Inc, NY, Papers 700708, and 700734, 30 p, 1970

Soc of Auto Engr, Intl Auto Engr Cong, Sel Papers, (Held in Detroit, Mich, Jan 13-17, 1969), In: Soc of Auto Engr Inc, NY, Papers 690014, 690017, 690010, 690087, 690088, 690138, 690141 and 690164, 166 p, 1969

Soc of Auto Engr, Mid-Year Meet, Sel Papers, (Held in Detroit, Mich, May 20-24, 1968), In: Soc of Auto Engr Inc, NY, Papers, 680398, 680400, 680402, 680420, 680421, 680443-680445 and 680463, 140 p, 1968

Soc of Auto Engr, Natl Combined Fuels and Lubricants and Transp Meet. Sel Papers, (Held in Houston, Tex, Nov 4-7, 1969), In: Soc of Auto Engr Inc, NY, Papers 690763-690765, 31 p, 1969

Soc of Auto Engr, West Coast Meet, Sel Papers, (Held in San Francisco, Calif, Aug 12-15, 1968), In: Soc of Auto Engr Inc, NY, Papers 680527-680529, 35 p, 1968

Soc of Exploration Geophysicists, 39th Annu Meet, Abstr, (Held in 1969), In: Geophysics, 34(6): 966-1020, Dec 1969

Soc of Naval Architects and Marine Engr, Annu Meet, 77th, (Held in NY,NY, Nov 12-14, 1969), In: Soc of Naval Architects and Marine Engr, Transactions, 77: 386 p, 1970

Soc of Petro Engr, 40th Annu Calif Regional Meet, Sel Papers, (Held in San Francisco, Calif, Nov 6-7, 1969), In: Soc of Petro Engr, Preprints SPE 2737, SPE 2752-SPE 2753, SPE 2757 and SPE 2799, 46 p, 1969

Soc of Toxicology, Annu Meet, 9th, Abstr, (Held in Atlanta, Ga, March 15-19, 1970), In: Toxicology and Appl Pharmacology, 16(3): 1-89, May 1970

Soc of Toxicology, Annu Meet, 10th, Abstr

Sogreah Info, English Ed, Brochure, Sogreah, Grenoble, France, 8 p, 1971

Solid Waste Disposal, Paper, Heaney, F.L.; Keane, C.V., 13 p, 1970

The Solid Waste Fact Book, Booklet, Glass Mft Inst Inc, Comm on Public Affairs, NY City, 24 p

Solid Waste Mgt: A List of Available Lit, U.S. Public Health Serv, Consumer Protect and Environ Health Serv, Environ Cont Admin, Bureau of Solid Waste Mgt, Cincinnati, Ohio, 27 p, Dec 1969

Solid Waste Mgt: Study and Plan, Tuscaloosa Area Council of Local Govt, Alabama, 115 p, April 1970

Solid Waste Operations Mgt, Training Course Manual, U.S. EPA, Solid Waste Mgt Office, Div of Tech Operations, Training Branch, Cincinnati, Ohio

Solid Waste Practices in Berkshire County: The Problems and Possibilities of Community Disposal Facilities, Schweighauser, C.A., Williams College, Centr for Environ Studies, Williamstown, Mass, 68 p, June 1969

Solid Waste Res and Devel, v III, Conf, Papers, (Hend in Beaver Dam, Wisc, July 22-26, 1968), Spon by Engr Foun, NY, NY, 178 p, 1968

Solid Waste Symp, 3rd Annu, Unbound Papers, (Held in San Jose, Calif, March 4-5, 1971), Spon by City of Santa Clara, Calif; San Jose State College, Calif and Govern Refuse Collection and Disposal Assoc, 1971

A Solid Wastes Mgt Syst for the Bay Region, Rep, Planning and REs Assoc, San Francisco, Calif, 34 p, 1970

A Solid Wastes Mgt Syst for the Bay Region, Rep, San Francisco Planning and Urban Renewal Assoc, Calif, 117 p, 1971

Solutions for Pollut in an Urban Environ, Conf, Abstr, (Held in Montreal, Quebec, Canada, Nov 30-Dec 1, 1970), Spon by Canadial Soc for Chem Engr and Chem Inst of Canada, Chem Economics Subdiv, 52 p, 1970

Some BioGeoChem Considerations on the RAdioactive Contamination of Marine Biota and Environ, Paper, Fukai, R., Pergamon Press, NY, 4 p, 1968

Something in the Air, Paper, Schaefer, V.J., 9 p

Sonic Boom Res, 2nd Conf, Proc, Schwartz, I.R. (ed), (Held in Wash DC, May 9-10, 1968), Spon by U.S. Natl Aero and Space Admin, Office of Advanced Res and Tech, Res Div, In: U.S. Natl Aeronau and Space Admin, Wash DC, Spec Publ SP-180, 193 p, 1968

A Sound Approach to Noise, Paper, Soporowski, J.J., Jr, 6 p, 1969

The Source Identification of Marine Hydrocarbons by Gas Chromatography, Paper, Ehrhardt, M. and Blumer, M., 31 p, 1971

S African Association for the Advancement of Sci, Capetown Cong, Program and Abstr, (Held in Capetown, S. Africa, June 29-July 5, 1970), 23 p, 1970

SW Pacific Geological Survey, Conf, Papers, Bodley, F.A. and Sutherland, N. (eds), (Held in Fiji, March 1966), In: New Zealand J of Geology and Geophysics, 13(1): 7-294, March 1970

Space-Age Metals and Ocean Tech, Paper, Brown, B.F., 5 p, Nov 5, 1969

Special Studies for Incenerators for the Govt of the Dist of Columbia, In: U.S. Public Health Serv, Consumer Protect and Environ Health Serv, Environ Cont Admin, Solid Wastes Program, Cincinnati, Ohio, Publ 1748, 82 p, 1968

Standing Tech Comm on Synthetic Detergents, of Papers, (Held in Wash DC, March 7-11, 1971), In: Toxicology and Appl Pharmacology, 19(2): 8, 384 p, 1969, Price: $20.00

Progress Rep, 11th, Ministry of Housing and Local Govt, Her Majesty's Stationery Office, London, 37 p, 1970

Status of Air Pollut From Mobile Sources with Recommendations for Further Action, Rep of the NJ Clean Air Council, NJ State Dept of Environ Protect, Trenton, 53 p, June 1970

Stomatopod Crustacea of the W Atlantic, Manning, R.B., In: Miami, Univ of, Coral Gables, Fla, Inst of Marine Sci, Tropical Oceanography

The Structure and Function of Fresh-Water Microbial Communities, Symp, Papers, Cairns, J., Jr, (ed), (Held in 1969), Spon by Amer Microscopical Soc, Columbus, Ohio, In: Va Polytechnic Inst and State Univ, Res Div, Blacksburg,, Monograph 3,300 p, 1970

Structure and Functioning of Estuarine Ecosyst Exposted to Treated Sewage Wastes, Annu Rep and Phase Rep, Kuenzler, E.J. and Chestnut, A.F. (eds) Univ of NC, Inst of Marine Sci, Chapel Hill, In: NC, Univ, Inst of Marine Sci, Chapel Hill, Annu Rep, 345 p, Feb 1971

Student Conf on Environ, Resolutions and Summaries of Other Regional Conf, (Held in Oakland, Calif, Dec 30, 1969), Spon by U.S. Dept of the Interior, Fed Water Pollut Cont Admin, Pacific NW Region, Corvallis, Ore, 125 p, 1970

A Study as to the Numbers and Characteristics of Oceanographic Personnel in the United States, 1967, Summary, Intl Oceanographic Foun, Miami, Fla, 77 p, Dec 1967, Price: $0,65

Study of Critical Environ Problems, Summary of Major Findings and Recommendations, (Held in Williamstown, Mass, July 30-31, 1979), Spon by Mass Inst of Tech, Cambridge, 33 p, 1970

Study of Strip and Surface Mining in Appalachia, An Interim Rep to the Appalachian Regional Comm, U.S. Dept of the Interior, Wash DC, 78 p, 1966, Price: $1.00

Sub-Bottom Penetration with Sonar, Paper, Zabloudil, K.F. and Caulfield, D.D., 14 p, Oct 1969

Suggested Model Waste Water Regulations for Coin Laundry Wastes, Paper, Natl Automatic Laundry and Cleaning Council, Chgo, Ill, 36 p, 1969

A Summary of Environ Studies on Water Problems by Investor-Owned Elect Utility Companies Recently Completed, Underway, and Proposed, Edison Elect Inst, NY City, 60 p, March 1971

Summary of Present Knowledge of the Chem of Air Pollut, Paper, Peters, M. S., 22 p, 1969

A Summary of Sanitary Landfill Guidelines, Brunner, D.R. and Keller, D.J. U.S. Public Health Serv, Bureau of Solid Waste Mgt, 15 p, 1970

Support for Sci--Antarctica, 1968 ed, Rep, U.S. Naval Support Force, Antarctica, History and Res Div, Wash DC, 52 p, Feb 1968, Price: $0.45

Surface Mining and Our Environ. A Spec Rep to the Nation, U.S. Dept of the Interior, Wash DC, 124 p, 1967, Price: $2.00

Surface Water Temp Measurements by Airborne Infrared Thermometry, Paper, Doyle, M.J., Jr., 4 p, Nov 1966

Symp on Air Quality Criteria, Proc, (Held in NY, NY, June 4-5, 1968), Spon by Air Pollut Cont Assoc; Amer Ind Hygiene Assoc; Amer Petro Inst; Ind Medical Assoc and Occupational Health Inst, In: J of Occupational Medicine, 10(9): 1-135, Sept 1968

Symp on Indian Ocean, Proc, (Held in New Delhi, India, March 2-4, 1967), Spon by Natl Inst of Sci of India and Indian Natl Comm on Oceanic Res, In: Natl Inst of Sci of India, Bull 38: 1-562, 1968, Price: R35.10

Symp on Machinery Noise, Amer Soc of Mech Engr, 1969 Winter Annu Meet, Papers, (Held in Los Angeles, Calif, Nov 17-19, 1969), Spon by Amer Soc of Mech Engr, Fluids Engr Div; Gas Turbine Power Div and Biochem and Human Factors Div, NU City, In: Amer Soc of Mech Engr, ASME Publs 69-WA/FE-30, 69-WA/GT-4, 69-WA/GT-6, 69-WA/FT-13, 156 p, 1969, Price: $15.00, $25.00 (non-members)

Symp on Toxic Wastes, Inst of Water Pollut Cont, Annu Conf, Proc, (Held on Douglas Isle of Man, England, Sept 16-19, 1969), In: Water Pollut Cont, 69(3): 235-352, 1970

Symp on Water Quality Criteria to Protect Aquatic Life, Amer Fisheries Soc, Annu Meet, 96th, Papers, Cooper, E.L. (ed), (Held in Kansas City, MO, Sept 1966), In: Amer Fisheries Soc, Spec Publ 4, 37 p, 1967, Price: $1.25

TVA Activities Related to Study and Cont of Eutrophication in the Tenn Valley, Meet, Papers, (Held in Muscle Shoals, Ala, April 29-30, 1970), Spon by Joint Ind/Govt Task Force on Eutrophication, In: Tenn Valley Authority, Natl Fertilizer Devel Centr, Muscle Shals, Ala, Bull Y-11, 92 p, Sept 1970

Taken for Granted, Rep, Ministry of Housing and Local Govt, Welsh Office, Working Party on Sewage Disposal, Great Britain, Her Majesty's Stationery Office, London, 71 p, 1970 , Price: $2.10

Tanker Conf, 15th Annu, Addresses, (Held in Absecon, NJ, April 27-19, 1970), Spon by Amer Petro Inst, Div of Transp, Central Comm on Transp by Water, Wash DC, 1[illegible]7 p, 1970

Tay Estuary Oil Pollut Scheme, Conf, Papers, (Held in Dundee, Scotland, April 15-16, 1970), 46 p, 1970

Tech and Social Problems of Air Pollut, Symp, Papers, Eloib, A. (ed), (Held in NY, NY, Feb 24, 1966), Spon by Metropolitan Engr Council on Air Resourc and Engr Foun, NY; Amer Inst of Chem Engr, NY; Amer Inst Mech Engr, NY; Amer Soc of Civil Engr, NY; Amer Soc of Mech Engr, NY; and Inst of Elect and Electronics Engr, NY, 95 p, 1966, Price: $2.00

Tech Assoc of the Pulp and Paper Ind, Water and Air Conf, 7th, Abstr, (Held in Minneapolis, Minn, June 7-10, 1970), In: Ind Water Engr, 7(7): 6-7, 9, July 1970

Tech Aspects of Joint Waste Treatment, Municipal/Ind, Inst, Proc, Litsky, W.; Gunner, H.B. and Kreplick, R. (eds), (Held in Farmingham, Mass, March 5-6, 1969), Spon by Univ of Mass, Tech Guidance Centr for Ind Water Pollut Cont, Amherst and Assoc Ind of Mass, 197 p, 1969, Price: $3.00

Technik Der Abfallbeseitigung, Band 2, Feld, E. and Knop, W., Buchreihe "Wasser Luft und Betrieb", Krausskopf-Verlag, Mainz, 198 p, 1967

Tech and Mgt of the Environ, Seminar, Papers, (Held in Corvallis, Ore, Spring 1971), Spon by Ore State Univ, Water Resourc Res Inst, Corvallis, 91 p, July 1971

Tech for the Future to Cont Ind and Urban Wastes, Symp, Proc, (Held in Rolla, MO, Feb 8-9, 1971), Spon by Univ of MO Continuing Education Series, Rolla, 125 p, 1971

Tell Me About Water Pollut. Questionnaire, Tex Water Quality Board, Austin, 6 p, July 1970

Teriiary Treatment of A Combined Wastewater with Granular Activated Carbon, Paper, Zanitsch, R.H. and Morand, J., 14 p, 1969

Tex Marine Resourc and the Sea Grant Program, Conf, Proc, (Held in College Station, Tex, Jan 16-17, 1969), Spon by Tex A&M Univ, Sea Grant Program, College Station, In: Tex A&M Univ, Sea Grant Program, Sea Grant Publ 104: 168 p, Oct 1969

Thermal Criteria--A Measure to Cont Thermal Pollut, Paper, Mathur, S.P. and Stevens, D.B., 10 p, 1969

Thermal Effects and Calif's Water, Paper, Adams, J.R., 13 p, 1969

Thermal Effluent Info Meet, Transactions, (Held in Boise, Idaho, July 9, 1970), Spon by Idaho Nuclear Energy Comm, 86 p, 1970

Thermal Pollut--The Effectiveness of Cooling Towers and Sprays as Solutions, Paper, Pita, E.G., 26 p, 1970

Thermal Pollut Notes, Seminar, 2nd, Papers, (Held in Chgo, Ill, Oct 20-22, 1970), Spon by Inst of Environ Sci, Mt Prospect, Ill, 83 p, 1970. Price: $10.00

Thermal Pollut of Cayuga Lake by a Proposed Power Plant, Paper, Citizens Comm to Save Cayuga Lake, Ithaca, NY, 12 p, 1968

A Thermal Profile of the Water of NY State, Rep, NY State Atomic and Space Devel Authority, 24 p, 1970

'Torrey Canyon' Pollut and Marine Life. A Rep by the Plymoutn Lab of the Marine Bio Assoc of the United Kingdon, Smith J.E. (ed), The Univ Press, Cambridge, 196 p, 1968, Price: $9.50

Toward a Cleaner Environ. A Rep on Chrysler Corp Efforts to Combat Pollut, Chrysler Corp, Press Info Serv, 28 p, May 1970

Toward a Quieter City, Rep of the Mayor's Task Force on Noise Cont, NY Board of Trade, 55 p, 1970, Price: $1.75

Trace Analysis, Chem Inst of Canada, Analytical Chem Div, 1970 Summer Symp Abstr of Papers, (Held in Edmonton, Alberta, Canada, Aug 20-21, 1970), 7 p, 1970

Trace Inorganics in Water, Amer Chem Soc, Meet, 153rd, Symp, Papers, Gould, R.F. (ed), (Held in Miami Beach, Fla, April 10-13, 1967), Spon by Amer Chem Soc, Div of Water, Air and Waste Chem, Amer Chem Soc, Advances in Chem Series 73, Wash DC 396 p, 1968, Price: $12.50

Trace Metals in Waters of the United States. A 5-Year Summary of Trace Metals in Rivers and Lakes of the United States (Oct 1, 1962-Sept 30, 1967), Kopp, J.F. and Kroner, R.C., U.S. Dept of the Interior, Fed Water Pollut Cont Admin, Div of Pollut Surveillance, Cincinnati, Ohio, 211 p, 1968

Trace Substances in Environ Health, Conf, 1st Annu, Proc, (Held in Columbia, MO, July 10-11, 1967), Spon by Univ of MO, Environ Health Centr and Ext Div, Columbia, 241 p, 1967

Trace Substances in Environ Health, Conf, 2nd Annu, Proc, Hemphill, D.D. (ed), (Held in Columbia MO, June 24-26, 1969), Spon by Univ of MO, Environ Health Centr and Ext Div, Columbia, 403 p, 1970

Trace Substances in Environ Health, Conf, 4th Annu, Abstr, Hemphill, D.D. (ed), (Held in Columbia, MO, June 23-25, 1970), Spon by Univ of MO, Environ Health Centr and Ext Div, Columbia, 62 p, 1970

Training Inst of the Environ Cont Admin, Bull of Courses July 1970 to Dec 1971, U.S. Dept of Health, Education and Welfare, Public Health Serv, Environ Health Serv, Cincinnati, Ohio 82 p, 1970

The Transp of Radioactive Material, Conf, Proc, (Held in Charlottesville, Va, Oct 26-28, 1969), Spon by Univ of Va, Dept of Conf and Inst, Charlottesville, 80 p, 1969, Price: $3.00

The Treatment and Disposal of Ind Effluent, Conf, Papers, (Held in London, England, Feb 16, 1970), Spon by Inst of Mech Engr, Process Engr Group, London, England, 97 p, 1970

The Treatment and Disposal of Wastes from Vegetable Processing: Progress and Res Needs, Conf, Proc, (Held in New Orleans, La, Aug 26, 1969), Jointly Spon by La Sweetpotato Comm; La State Univ, Dept of Horticulture Baton Rouge and U.S. Dept of Agric, Southern Utilization Res and Devel Div, New Orleans, La, In: U.S. Dept of Agric, Agric Res Serv, Publ ARS 72-80, 67 p, March 1970

Trends in Thermal Pollut Cont Requirements, Paper, Bregman, J.I., Water Pollut Res and Appl, Inc, Wash DC, 13 p, 1970

Tsunamis and Their Occurrence Along the San Diego County Coast, Paper, Joy, J.W., 61 p, June 1968

Turning Points in Time: Land/Water/People, Soil Conservation Soc of Amer, Annu Meet, 25th, Symp, Major Papers, (Held in Toronto, Ontario, Canada, Aut 9-12, 1970), 79 p, 1970

The United Nations and Ocean Mgt, Conf, 5th Annu, Proc, Alexander, L,M,, (ed), (Held in Kingston, R.I., June 15-19, 1970), Spon by Univ of R.I. Law of the Sea Inst, Kingston, 390 p, 1971

The United Nations and the Issue of Deep Ocean Resources Together with Hearings by the Subcomm on Intl Organiz and Movements of the Comm on Foreign Affairs, House of Repre, Interim Rep, U.S, Govt Printing Office, Wash DC, 307 p, 1967

United States Intl Bio Program, Thermal Workshop, 2nd, Proc, (Held in Solomons, Md, Nov 3-7, 1968), Spon by Natl Academy of Sci, Wash DC, In: Chesapeake Sci, 10(3-4): 125-341, Sept-Dec 1969

The Univ's Role in Natl Water Policy, Conf, Proc, Flack, J.E. (ed), (Held in Blacksburg, Va, July 27-28, 1970)

Univ, Natl Labs, and Mans Environ, Conf, Proc, Jared, D. (ed), (Held in Chgo, Ill, July 27-29, 1969), Spon by Argonne Univ Assoc, Chgo, Ill, U.S. Atomic Energy Comm, Div of Tech Info, Oak Ridge, tenn, 167 p, Nov 1969, Price: $3.00

Univ Council in Water Resourc, 133 p, 1970

Univ Curricula in the Marine Sci and Related Fields: Academic Years 1969-1970 and 1970-1971, Rep, Office of the Oceanographer of the Navy, Marine Sci Affairs Staff, Wash DC, 270 p, 1969, Price: $2.00

Univ of Miami, Rosenstiel School of Marine and Atmosph Sci and Gulf and Caribbean Fisheries Inst, Coral Gables, Fla, Annu Session, 22nd, Proc, (Held in Miami Beach, Fla, Nov 1969), 163 p, May 1970

The Univ of Tex Marine Sci Inst of Port Arkansas, Res and Graduate Instruction, Booklet, 16 p

The Univ Response to the Environ Crisis, Pamphlet, Univ of Colo, Comm on Environ Studies, Boulder, 13 p, 1970

Urban Air Pollut Damage Functions: Theory and Measurement Final Rep, Crocker, T.D., 187 p, 1971

Urban Climates, Symp on Urban Climates and Building Climatology, v I, Proc, (Held in Brussels, Belgium, Oct 1968), Jointly Spon by World Health Organiz, Geneva, Switzerland and World Meteorological Organiz, Geneva, Switzerland. In: World Meteorological Organiz, Geneva, Tech Note 108, 414 p, 1970, Price: $14.00

Urban Demands on Natural Resourc, Western Resourc Conf, Proc, (Held in Denver, Colo, 1970), Spon by Univ of Denver, Colo, 295 p, 1970

Urban Noise Evaluation and Cont, Paper, Kryter, K.D., 2 p, 1968

Use and Conservation of Biosphere, Intergovt Conf, Proc, (Held in Paris, France, Sept 13, 1968), Spon by United Nations Educational Sci and Cultural Organiz, Paris France; United Nations Educational Sci and Cultural Organiz, Natural Resourc Res Series v 10, Paris, 272 p, 1970, Price: $6.00

Use of a Ventilation Index in Air Quality Cont, Paper, Sandberg, J.S., 15 p, 1967

The Use of Polymers for Water Treatment, Paper, Sexsmith, D.R.; Savinelli, E.A.; and Beecher, J.S., Drew Chem Co, Process Chem Div, Boonton, NJ, 9 p, 1969

U.S. Navy Symp of Military Oceanography, 7th, v I, Proc, (Held in Annapolis, Md, May 12-14, 1970), Spon by Oceanographer of the Navy, U.S. Naval Ship Res and Devel Centr, Annapolis, Md, 324 p, 1970

U.S. Navy Symp on Military Oceanography, v I, Proc, (Held in Seattle, Wash, May 26-28, 1969), Spon by Oceanographer of the Navy, Univ of Wash, Appl Physics Lab, Seattle, 409 p, 1969
USSR Rep on Natural and Fallout Radioactivity, Translations, U.S. Atomic Energy Comm, Health and Safety Lab, NU, 145 p, 1970

Vectors, Paper, Ham, R.K., 25 p, 1970
Virus and Water Quality: Occurrence and Cont, Water Quality Conf, 13th, Proc, Sndeyink, V and Griffin, V. (eds), (Held in Urbana, Ill, Feb 15-16, 1971), Spon by Univ ov Ill, Dept of Civil Engr, Urbana-Champaign and Ill EPA, 226 p, 1971, Price: $4.50

Waste Water Mgt in Metropolitan Toronto, Paper, Clough, D.A., 23 p
Water and Sewer Charges as Related to Water Use and Waste Cont, Workshop, Proc, (Held in Rougemont, NC, Oct 1, 1969), Spon by Univ of NC, Water Resourc Res Inst, Chapel Hill. In: NC, Univ, Water Resourc Res Inst, Rep 30, 124 p, 1969
Waste Disposal, Intl Cong, 4th, Papers, (Held in Basel, Switzerland, June 2-5, 1969), Spon by Intl Res Group on Refuse Disposal. In: Schweizerische Zeitschrift Fuer Hydrologie, 31(2): 185-783, Dec 31, 1969
Waste Disposal From Water and Wastewater Treatment Processes, Sanitary Engr Conf, 10th, Proc, Austin, J.H. and Weise, U. (eds), (Held in Urbana, Ill, Feb 6-7, 1968), Spon by Univ of Ill, Dept of Civil Engr, Urbana and Ill Dept of Public Health, Div of Sanitary Engr, Springfield 152 p, 1968, Price: $4.00
Waste TReatment Lagoons, Intl Symp, Proc, McKinney, Ross, E. (ed), (Held in Kansas City, MO, June 23-25, 1970), Spon by MO Basin Engr Health Council, Kansas City and U.S. Dept of the Interior, Fed Quality Admin, Wash DC, 404 p, 1970
Water--1969, Symp, Papers, Cecil, L.K. (ed), Spon by Amer Inst of Chem Engr, NY City. In: Amer Inst of Chem Engr, Chem Engr Progress Symp Series, 65(97): 313 p, 1969
Water and Air Conf, 7th Abstr of Papers, (Held in Minneapolis, Minn, June 7-10, 1970), Spon by Tech Assoc of the Pulp and Paper Ind. In: Ind Water Engr, 7(7): 6-7, 9, July 1970
Water and Ore's Ecology, Seminar, Papers, (Held in Corvallis, Ore, Fall 1970), Spon by Ore State Univ, Water Resourc Res Inst, Corvallis, 171 p Jan 1971
Water ans Sewer Studies, A Master Plan Rep for the Atlantic County Planning Board, Atlantic City, NJ, 60 p, Oct 1969, Price: $0.65
The Water Chem Program at the Univ of Wisc, Paper, Univ of Wisc, Water Chem Lab, Madison, 15 p
The Water Planet, U.S. Naval Oceanographic Office, Wash DC, 50 p, 1969 Price: $1.00
Water Pollut, Paper, Hennigan, R.D., 12 p, 1969
Water Pollut, Workbook, Berg, G.A., Scientists Inst for Public Info, NY, NY, 32 p, 1970, Price: $1.00
Water Pollut by Oil, Seminar, Unbound Prepr, (Held in Aviemore, Scotland, May 4-8, 1970), Spon by Inst of Water Pollut Control; Inst of Petro, London, England and World Health Organiz, Regional Office for Europe, 1970

Water Pollut Cont Activities and the Interstate Air Pollut Program Rep, Interstate Sanitation Comm, 74 p, 1970

Water Pollut Cont: Exper Procedures for Process Design, Eckenfelder, W.W. and Ford, D.L., The Perberton Press, Jenkins Publ Co, Austin, 269 p, 1970, Price: $12.50

Water Pollut Cont Fed, Conf, 43rd Annu, Papers, (Held in Boston, Mass, Oct 4-9, 1970), In: Water Pollut Cont Fed, Wash DC, J, 42(9): 1585-1722, Sept 1970

Water Pollut Cont Fed, Statement to the U.S. House of Repre, Comm on Public Works, Canham, R.A., 9 p, July 27, 1971

Water Pollut Cont in Coastal AReas, Symp, Abstr, (Held in Bournemouth, England, May 20-20, 1970), Spon by Inst of Water Pollut Cont, Kent, England. In: Water Pollut Cont, 70(5): 575-577, 1971

Water Pollut in the Greater NY Area, Symp, Proc, Johnson, A.A. (ed), (Held in NY, NY, Dec 13, 1969), Spon by NU City Oceanographic Advisory Comm and NY State, Dept of Water Resourc, Gordon and Breach, Sci Publ, NY, 222 p, March 1970

Water Pollut Problems and Cont Programs in Mich Portion of the Great Lakes Rep, Mich Water Resourc Comm, 6 p

Water Pollut Res, Intl Conf and Exhibition, 5th, Abstr, (Held in San Francisco, Calif, July 26-Aug 1, 1970 and Honolulu, Hawaii, Aug 2-5, 1970), In: Ind Water Engr, 7(6): 59-72, June 1970

Water Pollut Res 1968, The Rep of the Water Pollut Res Lab Steering Comm with the Rep of the Director of Water Pollut Res, Her Majesty's Stationery Office, London, 200 p, 1969, Price: 17S. 6D

Water Production Engr in Tex, Symp, Proc, (Held in Austin, Tex, May 3, 1966), Spon by Univ of Tex, Dept of Mech Engr Program Austin, 128 p, 1966, Price: $3.00

Water Quality Behavior in Reservoirs, A Compilation of Publ Res Papers, Symons, J.M. (eds), In: U.S. Public Health Serv, Publ 1930, 616 p, 1969, Price: $3.25

Water Quality Cont, Short Course, Papers, (Held in Amherst, Mass, March 23-25, 1970), Cospon by Univ of Mass, School of Engr, Dept of Civil Engr, Environ Engr Program; and Univ ov Mass, Tech Guidance Centr for Ind Environ Cont, 308 p, 1970

Water Quality Criteria for Interstate and Coastal Waters, Regulation 1-67A, State of Mississippi, Air and Water Pollut Cont Comm, Jackson, 12 p, March 1968

Water Quality Improvement by Physical and Chem Process, Water Resourc Symp 3, Papers, Gloyna, E.F. and Eckenfelder, W.W., Jr, (eds), (Held in Austin, Tex, April 1969), Spon by Univ of Tex, Centr for Res in Water Resourc, Austin, Univ of Tex Press, Austin, 448 p, 1970, Price: $15.00

Water Quality Standards for Interstate and Coastal Waters of the State of Wash and a Plan for Implementation and Enforcement of Such Standards, Regulation, State of Wash, Water Pollut Cont Comm, 25 p, Feb 1970

Water REfuse Survey of Petro Refineries, Paper, Weil, R.V. and Jackson, G.F., 14 p, 1969

Water Resourc Mgt in the Upper Potomac, Interstate Comm on the Potomac River Basin, Annu Fall Public Meet, Papers, (Held in Harrisonburg, Va, Nov 5-6, 1970), 132 p, 1970

Water Resourc Res Conf, 5th Annu, Rep, (Held in Wash DC, Feb 3-4, 1970), Spon by U.S. Dept of the Interior, Office of Water Resourc Res, Wash DC, 261 p, 1970

Water Resourc--The Role of the Univ Community, Univ-Wide Conf, Sel Proc, Henniggn, R.D. and Hawkins, R.H. (eds), (Held in Syracuse, NU, March 12-14, 1969), Spon by State Univ of NY, Water Resourc Center, Syracuse. In: NY (state) College of Forestry, Syracuse, Water Resourc Centr, Rep 4, 59 p, Sept 1969

Water Quality Criteria for Interstate Waters, Regulation, State of Mississippi, Air and Water Pollut Cont Comm, Jackson, 13 p, 1970

The Water Situation in Sweden 1969, Rep, Natl Swedish Environ Protect Board, Solna, 19 p, 1969

The Water Situation in Sweden 1970, Rep, Natl Swedish Environ Protect Board, Solna, 18 p, 1970

Water: Solutions to a Problem of Supply and Demand, Overman, M., Aldus Books, Aldus Sci and Tech Series, London, 192 p, 1968, Price: 16S

Water Treatment Plant Design, Amer Soc of Civil Engr, Amer Water Works Assoc, and Conf of State Sanitary Engr, Amer Water Works Assoc, Inc, NY, NY, 353 p, 1969, Price: $7.50, $15.00 (non-members)

Watersheds: Framework for Community Action, Natl Watershed Cong, 16th, Papers, (Held in Louisville, Ky, June 8-11, 1969), 163 p, 1969

Weeds and Weed Cont, Swedish Weed Conf, 11th, Proc, (Held in Uppsala, Sweden, Jan 27-28, 1970), Spon by College of Agric, Dept of Plant Husbandry and Res Info Centr, Uppsala, Sweden, 167 p, 1970

Weeds and Weed Cont, Swedish Weed Conf, 10th, Proc, (Held in Uppsala, Sweden, Jan 22-23, 1969), Spon by College of Agric, Dept of Plant Husbandry and Res Info Centr, Uppsala, Sweden, 76 p, 1969

Weeds and Weed Cont, Swedish Weed Conf, Papers, (Held in Uppsala, Sweden, Jan 28-29, 1971), Spon by College of Agric, Dept of Animal Husbandry and Res Info Centr, Uppsala, Sweden, 200 p, 1971

Western Soc of Naturalists, 15th Annu Meet, Abstr of Symp and Contributed Papers, (Held in Los Angeles, Calif, Dec 27-20, 1969), Abstracts Avail from Calif State Polytechnic College, San Luis Obisop, 32 p, 1969

"What Price Environ", Paper, Livermore, N.B., Jr, 24 p, May 1970

Workshop on Marine Wire Rope, Papers, (Held in Wash DC, Aug 11-13, 1970), Spon by Office of Naval Res; Naval Ships Command (Supervisor of Salvage); Catholic Univ of Amer and Natl Oceanographic Instrumentation Centr, 102 p, 1970

World Distribution of Thunderstorm Days, II, Tables of Marine Data and World Maps, Rep, World Meteorological Organiz (WMO), Geneva, Switzerland, 72 p, 1955, Price: $6.50

Yell-O-Pages: Environ Resourc, Directory, Howell, E; Holshouser, L. and Puglisi, G. (eds), Environ Resourc Ind, Wash DC, 247 p, 1971, Price: $10.00

You and Your Environ. Pamphlet, Amer Assoc of Univ Women, San Diego County Brances, Calif 20 p, 1971

APPENDIX B

ABSTRACTS

AIRCRAFT NOISE

Engine Inlet Noise

Fathy, A. B.; Lumsdaine, E.
NEW METHOD OF SOLVING ONE-DIMENSIONAL UNSTEADY FLOW EQUATIONS AND ITS APPLICATION TO SHOCK WAVE STABILITY IN SONIC INLETS
Midwest Mech Conf, 13th, Proc, Univ of Pittsburgh, Pa, Aug 13-15, 1973, Paper 12, p 153-166. Available from Univ of Pittsburgh, Sch of Engr, Pa, 1973

A new procedure of solving one-dimensional unsteady flow problems, when the assumption of small perturbations is permissible, is presented. The method is illustrated through its application to the problem of shock wave stability in sonic inlets and was found to adequately predict the dynamic characteristics of the inlet whenever the one-dimensional approximation is acceptable. It also showed that sonic inlets are essentially stable. 13 refs.

Hancock, R. N.
INLET DUCT SONIC FATIGUE INDUCED BY THE MULTIPLE PURE TONES OF A HIGH BYPASS RATIO TURBOFAN
Inst of Environ Sci, Annu Tech Meet, 19th, Proc, Anaheim, Calif, Apr 2-5, 1973. Available from Inst of Environ Sci, Mt. Prospect, Ill, 1973, p 313-319

Requirements for the redesign of an engine inlet duct to withstand sonic fatigue prompted the measurement of the duct acoustic environment forward of a 6.2 bypass ratio turbofan. Several axial and circumferential positions were utilized to characterize the noise incident on the internal nacelle structure. These data are briefly related to other measurements from a 0.75 bypass ratio fan. These measurements are summarized, including waveform, harmonic content and amplitude for various duct locations and fan operating conditions. A shaker test procedure was devised to test redesigned duct components to withstand sonic fatigue. This procedure, duplicating high frequency modal response, is discussed. 7 refs.

Livesey, J. L.; Odukwe, A. O.
SOME EFFECTS OF PIPE FLOW GENERATED ENTRY CONDITIONS ON THE PERFORMANCE OF STRAIGHT WALLED CONICAL DIFFUSERS WITH HIGH SUBSONIC ENTRY MACH NUMBER
ISR J Technol, v 11 n 4, 1973, p 217-222

The inlet Mach number was varied from 0.3 to choking while the Reynolds number varied between 4.0×10^5 and 1.07×10^6. The diffuser inlet condition is defined in the absence of the diffuser and ineffectively infinitely long pipe; thus the effect of the sharp transition is correctly attributed to the diffuser in the assessment of its losses. The results indicate a deterioration and then improvement in diffuser performance as the entry length increases. Contrary to previously obtained results, the effect of inlet Mach number is neither consistently advantageous nor disadvantageous. refs.

Zallen, D. M.
ENGINE INLET NOISE RESULTING FROM SHOCK WAVE IMPINGEMENT
Noise and Vibr Control Engr Conf, Proc, 1972, p XV-XXV

Gas dynamic disturbances in an engine inlet duct and at the compressor face that would result from a blast wave impinging on a moving aircraft were analyzed. The dynamic wave system with accompanying overpressure and maximum distortion were predicted. The basic study considers the shock wave strength modification due to capture area ratio, duct area change, and wave reflection at the compressor face. The results of this engine inlet analysis can be used as input into methods, e.g., dynamic engine simulation, for determining engine response to such noise.

Duct Noise - General

Baumeister, K. J.
APPLICATION OF FINITE DIFFERENCE TECHNIQUES TO NOISE PROPAGATION IN JET ENGINE DUCTS
ASME Paper 73-WA/GT-10 for Meet Nov 11-15, 1973,

A finite difference formulation is presented for wave propagation in a rectangular two-dimensional duct without steady flow. The difference technique, which should be used in the study of acoustically treated inlet and exhausts ducts used in turbofan engines, can readily handle acoustical flow field complications such as axial variations in wall impedance and cross section area. In the numerical analysis, the continuous acoustic field is lumped into a series of grid points in which the pressure and velocity at each grid point are separated into real and imaginary terms. An example calculation is also presented for the sound attenuation in a two-dimensional straight soft-walled suppressor. 9 refs.

Goldstein, M.; Rice, E.
EFFECT OF SHEAR ON DUCT WALL IMPEDANCE
J Sound and Vibr, v 30 n 1, Sept 8, 1973, p 79-84

Information on the reduction of turbofan engine noise is provided. The solution to the equation governing the propagation of sound in a uniform shear layer is expressed in terms of parabolic cylinder functions. This result is used to develop a closed form solution for acoustic wall impedance which accounts for both the duct liner and the presence of a boundary layer in the duct. The effective wall impedance can then be used as the boundary condition for the much simpler problem of sound propagation in uniform flow.

Tam,
ON FINITE AMPLITUDE SPINNING ACOUSTIC MODES AND SUBSONIC CHOKING
J Sound Vibr, v 16 n 3, June 8, 1971, p 393-405

The propagation of small but finite amplitude spinning acoustic wave modes in an annular duct is studied. The usual frequency dispersion relation of linear theory is extended to include the nonlinear effect of amplitude dispersion. A perturbation procedure in which the frequency, wavenumber, and amplitude relation is represented . It is found that nonlinear effects are not negligible for wave modes of moderate amplitude. The phenomenon of 'subsonic choking' of these waves due to finite amplitude effect are investigated. The physical aspects of this phenomenon are also discussed. 13 refs.

Sound Absorbent Material

Ko, S.-H.
SOUND ATTENUATION IN LINED RECTANGULAR DUCTS WITH FLOW AND ITS APPLICATION TO THE REDUCTION OF AIRCRAFT ENGINE NOISE
Acous Soc Amer J, v 50 n 6, Dec 1971, p 1418-1432

Sound attenuation in a rectangular duct with two sides lined and with a uniform steady flow is investigated. The fundamental mode is not necessarily the least attenuated in lined ducts. Sound attenuation is influenced by the fluid flow: tuning frequency shifts to higher frequency with decreasing peak attenuation for downstream propagation and to lower frequency with increasing peak attenuations for upstream propagation. The effect of acoustic impedance on sound attenuation for a given duct geometry is presented as well as the effect of duct geometry on sound attenuation for a given acoustic impedance. Theoretically predicted attenuation spectra are compared with experimental results. The predicted attenuation spectra are in a very good agreement with the experimental results for downstream propagation. However, the present theory overpredicts the sound attenuation for upstream propagation.

Mangiarotty Civil Aviation RA
REDUCTION OF AIRCRAFT ENGINE FAN-COMPRESSOR NOISE USING ACOUSTIC LININGS
J Sound Vibr, v 18 n 4, Oct 22, 1971, p 565-76

The development of a method is described for reducing the approach-landing noise of commercial jet transports by means of acoustic linings for attenuating the noise generated by the fan-compressor in turbofan engines and radiated from the intake and fan-exit ducts. A brief discussion is given on the general characteristics of aircraft subjective noise spectra, engine noise reduction techniques, results of research and development on acoustic linings, lining technology and full scale testing. Finally, a summary of areas of lining research and technology requiring further investigation is given. 6 refs.

Manson, L.; Lieberman, S.
SOUND PROPAGATION AND ABSORPTION IN FOAM. A DISTRIBUTED PARAMETER MODEL
J Acoust Soc Amer, v 50 n 4, pt 1, Oct 1971, p 1075-80

A better understanding of the mechanisms of sound absorption in foams was sought in a mechanical model of bubble pulsation and coupling and the development of a distributed-parameter mechanical analog. Sound propagation and absorption mechanisms were shown to be accurately described by the resonant response of individual bubbles coupled to neighboring bubbles. Application is to noise reduction in aircraft jet engines. 14 refs.

McDaniel, O. H.
PERFORMANCE OF ABSORPTIVE LINERS IN THE PRESENCE OF SPINNING MODES
Noise and Vibr Control Engr Conf, Proc, 1972, p XV-XXV

The radiated noise due to jet engine fans and compressors can be reduced by the application of absorptive treatment to the engine inlet and exhaust ducts. A research program is being conducted to develop theoretical and experimental methods to make optimum use of various absorption mechanisms in order to obtain maximum noise reduction at a minimum loss in the aircraft performance. Some results of the first phase of the program which deal with the performance of liners made of several absorptive materials in the presence of spinning modes in the linear region are presented, and these results are compared with absorption coefficient measurements made with an impedance tube and using a free field technique.

Woodall, J. F.
QUIETING THE JT3D POWERED 707
SV Sound Vibr, v 8 n 2, Feb 1974, p 20-25

Flightweight, flightworthy, acoustically treated engine nacelles have been developed for the Boeing 707. The analytical techniques, predicted acoustics performance, Ground test data, and flight test data confirmed that a retrofitted aircraft can comply with the noise requirements prescribed by the Federal Aviation Agency for certification. 8 refs.

Fan Noise

Noise Generation-

Barry, B.; Moore, C. J.
SUBSONIC FAN NOISE
J Sound Vibr, v 17 n 2, July 22, 1971, p 207-20

Helicopter rotor noise theories are used to determine the noise of subsonic fans produced solely by the rotor, which results from aerodynamic intake flow distortions. It is shown that the aerodynamic interaction of intake distortions with the blades will result in both rotor order tones and broad-band noise. The dominance of the one over the other depends on the space-time correlation of the distortions and the magnitude of typical fan length and time scales. Modulation effects are considered.

Benzakein, M. J.
RESEARCH ON FAN NOISE GENERATION
J Acoust Soc Amer, v 51 n 5, part 1, May 1972, p 1427-1438

Various aspects of multiple-pure-tone broadband noise generation in high speed fans are discussed and an analytical model presented. Such noise generation does not seem to depend on the presence of shock waves. The "broadband" noise is shown to be not actually broadband in character but could be attributed to modulation of blade-passing-frequency tones, their subharmonics and higher harmonics.

Burdsall, E. A.
RECENT STUDIES OF FAN NOISE GENERATION AND REDUCTION
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, 1972, p 2-4

Discrete tone, broadband and combination tone noise in aircraft engine fans is discussed, and the development of an accurate fan noise prediction system that enables selection of proper acoustical design choices for engines is described. Noise reduction in a modern high tip speed fan vehicle is also investigated.

Cumpsty, N. A.; Lowrie, B. W.
CAUSE OF TONE GENERATION BY AERO-ENGINE FANS AT HIGH SUBSONIC TIP SPEEDS AND THE EFFECT OF FORWARD SPEED
ASME Paper VN 73-WA/GT for Meet Nov 11-15, 1973,

Modern aero-engine fans (without inlet guide vanes) produce a tone at blade passing frequency by interacting with the inlet flow distortion. Because the distortion is altered by forward motion of the aircraft the tone is also different under static and inflight conditions. At low tip relative Mach numbers (less than about 0.85) the significant source of distortion is the intake wall boundary layer. At higher tip Mach numbers the principal distortion under static conditions is the atmospheric turbulence drawn into the intake, but in flight this reduces and other forms of distortion may then dominate. 6 refs.

Lowson, M. V.
SOME EXPERIMENTS ON FAN NOISE AND THEIR IMPLICATIONS
Acous Soc Amer, New York J, v 52 n 1, July 1972, p 112-188

Noise output from an open rotor was measured in an anechoic room. Simultaneously measurements of the aerodynamic input to the fan were made. The aeroacoustic transfer function was thus measured and compared to various theoretical models. The fan noise output is due to three sources: distorted inflow, turbulent inflow, and self-generated tip noise. The latter source is significant at higher frequencies and may dominate subjective noise levels for both ventilating fans and low-speed geared fans for aircraft use. This noise source can be successfully attacked via blade-tip modifications which can give noise reductions of over 10 dB.

Mather, J.S.B.; Savidge, J.; Fisher, M. J.
NEW OBSERVATIONS ON TONE GENERATION IN FANS
J Sound Vibr, v 16 n 3, June 8, 1971, p 407-18

A theory to describe the generation of discrete tone noise by the aerodynamic interaction of rotor and stator rows in turbomachinery when the rotor blades are not precisely identical is presented. Experimental data, taken from measurements of the far-field of a number of free vortex transonic compressors, confirms the predictions of the theory and shows that this type of interaction may be expected to occur in all fans and compressors in current aeroengines.

Metzger, F. B.; Hanson, D. B.
LOW PRESSURE RATIO FAN NOISE EXPERIMENT AND THEORY
ASME Paper 72-GT-40 for Meet Mar 26-30, 1972

The Q-Fantm, a new low pressure ratio, low noise propulsor, is currently under intensive development. Since the operating regime of the Q-fan differs from that of the turbofan, the dominant noise sources also differ. This paper includes a summary of the results of extensive noise tests on a Q-fan model, a discussion of the sources of various components of measured fan noise, and the results of analytical studies using a new theory to define minimum noise fan configuration. 13 refs.

Mugridgf, B. D.; Morfey, C. L.
SOURCES OF NOISE IN AXIAL FLOW FANS
J Acous Soc Amer, v 51 n 5, part 1, May 1972, p 1411-1426

A review is given of experiments and theory relating to fan noise sources and the physical processes for the flow processes analyzed for the case of axial flow machines. The mode of generation of unsteady lift by turbulence is included. Order-of-magnitude sound power estimates are compared where possible with experimental results. 55 refs.

Reethof, G.
AIRCRAFT FAN AND COMPRESSOR NOISE GENERATION -- A REVIEW
Noise Vibr Control Engr Conf, Proc, 1972, p XV-XXV

Over the last 10 years the understanding of the nature of noise sources in fans and compressors has increased as has the understanding of propagation of the complex acoustic modes in ducts and from duct exits. The experience of the aircraft industry indicates that only a systems approach can result in significant noise reductions without unacceptable performance degradations and weight increases of aircraft. The mechanisms of noise generation in fans and compressors and analytical considerations are discussed, and the state of the art of noise prediction methods is briefly reviewed. It is noted that prediction techniques based on published data for fans and compressors appears to be considerably behind the current state of understanding of the mechanism of noise generation and propagation.

Effects -

Hanson, D. B.
UNIFIED ANALYSIS OF FAN STATOR NOISE
Acous Soc of Amer J, v 54 n 6, Dec 1973, p 1571-1591

A theory is developed which predicts the acoustic radiation of an axial-flow fan stator due to interaction with rotor viscous wakes. Calculations are compared in detail with experimental data. Both the harmonic and broadband noise-spectrum components are calculated from a unified model using methodology from the theories of random pulse amplitude modulation (PPM). The stator is modeled as a circular array of pulsed dipoles. The amplitude and arrival time of each pulse are random variables whose means correspond to the values calculated from harmonic rotor-stator interaction theory. The SD's of these random variables are measures of the turbulence levels in the blade wakes. For the proposed model the solution is exact; when PAM is imposed on a periodic stator source, new broadband energy is generated whose spectrum shape is similar to the envelope of harmonics at high frequencies and the harmonic radiation is unchanged; however, when PPM occurs, new broadband energy is radiated but at the expense of harmonic energy. At frequencies significantly above duct cutoff, the spectrum is essentially independent of the number of stator vanes for a fixed stator solidity.

Krishnappa, G.
BLADE INTERACTION NOISE FROM LIFT FANS
J Acous Soc Amer, v 51 n 5, part 1, May 1972, p 1464-1470

Discrete frequency noise radiation from a single-stage lifting fan is analytically estimated from measured steady and unsteady aerodynamic data on the fan and compared with measured noise levels under controlled conditions. Viscous wakes shed by rotor blades are measured and viscous interference noise estimated. The relative importance of potential-flow interaction and viscous wake is also discussed, 11 refs.

Sofrin, T. G.
FAN NOISE MECHANISMS AND CONTROL--I
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, 1972, p 2-4

Three processes are involved in aircraft fan noise: generation, duct propagation, and radiation. Fan Noise is generated at the rotating blades and stationary vanes; discrete frequency blade passage noise and multiple pure tone noise generated by fan aerodynamic loads take the form of coherent periodic acoustic wave patterns in fan inlet and exit ducts. These patterns propagate in spiral paths to the free ends and they radiate to free space. Control of fan noise has been accomplished by eliminating inlet vanes; increasing the spacing between rotating and stationary blade rows; reducing fan tip speed; eliminating the second stage fan and its interstage stator; and using a stator vane number to control interaction effects. Prediction of fan noise is considered.

Lowson, M. V.
FAN NOISE MECHANISMS AND CONTROL--II
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, 1972, p 2-4

Noise measurements were made on a low speed fan mounted in an anechoic room and three principal source components were established: discrete frequencies governed by inflow distortion, LF broadband noise controlled by inflow turbulence and HF broadband noise regulated by blade tips. Control of fan noise at its source appears to be a matter of minimizing nonuniformities in the fan inflow and choosing an optimum tipshape.

Semrau, W. R.
EFFECTS OF BLADE-VANE SPACING ON FAN NOISE
Acous Soc Amer, New York J, v 53 n 1, Jan 1973, p 291-392

Definitive experimental knowledge of discrete-frequency noise reduction, which can be obtained in an aircraft turbofan engine through increased axial spacing between the fan rotor and outlet guide vanes, has been lacking. Using a unique heavy-gas scale model anechoic test facility, reaward radiated discrete frequency and broadband noise was investigated for a scale model fan. Data have been obtained for fan tip Mach numbers of 0.7 to 1.4, and rotor to OGV spacings of 0.13, 0.5, 1.0, and 2.0 rotor chords. Discrete frequency noise reductions up to 17 dB were obtained. At close spacing, discrete frequency reduction was at a rate greater than 6 dB/double spacing. Relative harmonic content was not influenced by spacing and reduction was independent of rotor speed. No significant change in broadband noise was observed.

Weidmann, J.
ANALYSIS OF THE RELATIONS BETWEEN ACOUSTIC AND AERODYNAMIC PARAMETERS FOR A SERIES OF DIMENSIONALLY SIMILAR CENTRIFUGAL FAN ROTORS (BEITRAG ZUR ANALYSE DER BEZIEHUNGEN ZWISCHEN DEN AKUSTISCHEN UND STROEMUNGSTECHNISCHEN PARAMETERN AM BEISPIEL GEOMETRISCH AEHNLICHER RADIALVENTILATOR-LAUFRAEDER)
Deut Luft Raumfahrt, Forschungsber 71-12, 1971

Experiments were made with a fan blowing against a sharp edge. It was shown that the frequency dependence of the sound pressure established in the free field is essentially determined by velocity fluctuations on the edge and, independently thereof, by the dimension to the wavelength ratio. 27 refs. In German with English abstract.

Design for Noise Reduction-

Chanaud, Robert C.
NOISE REDUCTION IN PROPELLER FANS USING POROUS BLADES AT FREE-FLOW CONDITIONS
Acous Soc Amer J, v 51 n 1, Jan 1972, p 15-18

Experiments were conducted on propeller fan blades at free-flow conditions to determine the noise reduction associated with the use of rigid porous materials as the blade material in lieu of solid material. The results suggest that significant reduction can be achieved with no loss of pumping efficiency when the pitch angle is increased from normal.

Coleman, H. J.
HAWKER SIDDELY, ROLLS TO TEST HS.125 WITH SOUND SUPPRESSION
Avia Wk & Space Tech, v 99 n 13, Sept 24, 1973, p 57-58, 63

An HS.125 business jet fitted with a variety of sound suppression devices aimed at bettering Federal Aviation Regulations Part 36 by the mid-1974 compliance date is being tested. The plan is to develop a comprehensive and cost effective hush kit program involving existing Rolls-Royce Viper 600 series engines, with current engineering work already underway on fundamental design changes that could include a redesigned fan and compressor to give a higher mass flow. Preliminary testing, projected test programs, complementary projects, and anticipated results are discussed.

Loeffler, I. J.; Lieblein, S.; Stockman, N. O.
EFFECT OF ROTOR DESIGN TIP SPEED ON NOISE OF A 1.21 PRESSURE RATIO MODEL FAN UNDER STATIC CONDITIONS
ASME Paper 73-WA/GT-11 for Meet Nov 11-15, 1973

Preliminary results are presented for a reverberant-field noise investigation of three fan stages designed for the same overall total pressure ratio of 1.21 at different rotor tip speeds (750, 900, and 1050 fps). The stages were tested statically in a 14-in. diam model lift fan installed in a wind pod located in the test section of a wind tunnel.

Although the fan stages produced essentially the same design pressure ratio, marked differences were observed in the variation of fan noise with fan operating speed. At design speed, the forward-radiated sound power level was approximately the same for the 750 and 900 fps stages. For the 1050 fps stage, the design speed forward-radiated power level was about 7 dB higher due to the generation of multiple pure tone noise.

Metzger, F. R.; Worobel, R.
NEW LOW PRESSURE RATIO FANS FOR QUIET BUSINESS AIRCRAFT PROPULSION
SAE Paper 730288 for Meet Apr 3-6, 1973

In this paper an alternative to the propeller as a propulsor for general aviation aircraft is discussed. This is the subsonic tip speed low-pressure ratio fan which can be mated to turboshaft, rotary combustion, or reciprocating engines to provide a low noise propulsor in a small package. Information is presented which shows tradeoffs among noise, weight, size, cost, and performance. Examples are included to show the influence of various noise targets on fan configuration and engine muffler requirements. 11 refs.

Thomas, W. W.
TURBOTIP LIFT FAN DESIGN
ASME Paper 72-GT-111 for Meet Mar 26-30, 1972

Discusses the basic design approach and features of the turbotip lift fan concept, initially developed for application in the XV-5 VTOL research aircraft. Design changes necessary to meet the requirements of the proposed NASA V/STOL transport research aircraft and future commercial transport systems are reviewed. Emphasis is placed on the effects of acoustic, installation, control response and life/maintenance objectives on component design and lift fan geometry.

Sonic Fatigue in Structures-

Holehouse, I.
SONIC FATIGUE OF AIRCRAFT STRUCTURES DUE TO JET ENGINE FAN NOISE
J Sound Vibr, v 17 n 3, Aug 8, 1971, p 287-98

The effects on aircraft structures of high frequency fan noise from high by-pass ratio turbofan engines is discussed. Actual case histories and investigative details are presented. Considerations essential to a proper failure diagnosis are outlined and precautionary measures for future design efforts are suggested.

Transmission of Sound Waves-

Koch, W.
ON THE TRANSMISSION OF SOUND WAVES THROUGH A BLADE ROW
J Sound Vibr, v 18 n 1, Sept 8, 1971, p 111-28

The problem of the transmission and reflection of plane sound waves incident upon a single cascade of finite plates is solved using the Wiener-Hopf technique. The results are given in explicit form containing an infinite number of constants. These constants, which are related to the attenuated waves in the 'duct' formed by two adjacent blades, have to be determined from an infinite system of linear, algebraic equations. An iterative solution is possible and converges rapidly in most cases. But even without taking these attenuated modes into account (equivalent to a zeroth approximation) good agreement with previous results is obtained. 16 refs.

Compressor Noise

Moravec, Z.
EINIGE ERKENNTNISSE UEBER DIE ENTSTEHUNG DES SIRENENLAERMS DER AXIALEN VERDICHTERSCHAUFELSTUFE (SOME FINDINGS RELATED TO THE ORIGIN OF THE SIREN-LIKE NOISE OF THE BLADE STATE OF AXIAL COMPRESSOR)
Oesterr Ing-Z, v 15 n 7, Jul 1972, p 199-203

10 refs. In German.

Oslac, M. J.; Seiner, J. M.
AN INVESTIGATION OF COMPRESSOR NOISE BY USE OF A SPINNING MODE SYNTHESIZER
Noise and Vibr Control Engr Conf Proc, 1972, p XV-XXV

Commerical fan engines or model test rigs have exhibited limiting factors in studies attempting to relate the pertinent parameters of spinning modes or waves to the acoustical characteristics of various duct treatments. The spinning mode synthesizer, developed at Pennyslvania State University, was designed to provide a means for making induct measurements of the radial, axial and circumferential modal distributions. The results of experiments conducted with the synthesizer are presented and give excellent justification for utilizing the device for testing the absorptive qualities of duct liners in the presence of spinning waves. It further enables more basic research to be done in the area of complex modes in variable geometry cylindrical ducts.

Jet Engine Noise

Refan-

McRae, G. M.
REFANNED COMMERCIAL GAS TURBINE ENGINES
SAE Paper 730346 for Meet Apr 24-26, 1973

A NASA sponsored program to develop noise reduction modifications for the JT3D and JT8D engines was initiated in August 1972. New higher flow single stage fans are attractive and result in higher bypass ratios with improved thrust and fuel consumption and reduced jet velocities. Flyover noise reductions as great as 20 EPN dB are shown for the modified engines with nacelle treatment. Engine certification can be completed and production hardware for fleet retrofit or new airplanes can be provided by late 1975.

Gas Turbine Exhaust-

Cummins, J. R.
ACOUSTIC CHARACTERISTICS OF GAS TURBINE EXHAUST MODEL
ASME Paper 73-WA/GT-5 for Meet Nov 11-15, 1973

To investigate the sources of acoustic radiation from a gas turbine exhaust, a one-seventh scale model has been constructed. The model geometrically scales the flow path downstream of the rotating parts including support struts and turning vanes. A discussion and comparison of different kinds of aerodynamic and acoustic scaling techniques are given. The effect of the temperature ratio between model and prototype is found to be an important parameter in comparing acoustical data.

Bypass Lift Engine-

Kurzke, J.
ZUR LAERMENTWICKLUNG UND AUSLEGUNG VON BYPASS-HUBTRIEBWERKEN. (NOISE DEVELOPMENT AND DESIGN OF BYPASS LIFT JET ENGINES)
Z Flugwiss, v 21 n 10, Oct 1973, p 337-345

Noise development of bypass lift jet engines influences considerably their design. In order to be able to make statements on some important parameters, a relationship between aerodynamic and acoustic data must be provided. The first part of this paper deals with noise radiation in the outlet part of bypass engines. An application of the previously derived correlations to an aft-fan lift engine of special construction follows in the second part. Moreover, it appeared that, with prescribed noise limits, the maximum technically attainable turbine inlet temperature does not necessarily lead to the most favorable specific thrust and consumption values. 24 refs. In German.

High Bypass Turbofan Engines -

Benzakein, M. J.; Smith, E. B.
TURBINE NOISE GENERATION AND SUPPRESSION
ASME Paper 73-WA/GT-7 for Meet Nov 11-15, 1973

An analytical method for the prediction of turbine generated noise is discussed. The method links the duct acoustic modes with the turbomachinery aerodynamics. The results of the analysis are compared with turbine component and engine results. Component data on the effects of the variation of axial spacing between blade rows on turbine aerodynamics and acoustics are presented. The results of an experimental evaluation of the relative importance of turbine noise on highly suppressed bypass turbofans are discussed. The development of high temperature acoustic treatment and its application to high bypass turbofans are presented. 8 refs.

Hoover, R. M.
LOW FREQUENCY NOISE OF GAS TURBINES
Acous Soc Amer, New York J, v 53 n 1, Jan 1973, p 291-292

With many electric utility gas turbine installations, the most difficult noise problem has been the control of LF noise radiated to the community from the turbine exhaust. A number of case histories are discussed leading to some suggestions for noise control design goals for the 31.5 Hz octave band. Some material is presented on noise spectra, noise control measures, and noise specifications for gas turbines pertinent to low frequencies.

Hourmouziadis, J.
OPTIMERUNG DES ZWEIKREISTRIEBWERKS UNTER BERUECKSICHTIGUNG DES LAERMS
(OPTIMIAZATION OF TURBOFAN CYCLE PARAMETERS WITH RESPECT TO NOISE ABATEMENT
Konstr Masch App Geraetebau, v 25 n 10, Oct 1973, p 377-382

Design criteria for a quieter engine design using the bypass pressure equalization method are discussed. Test results of various jet engines with different modifications for noise suppression are given. Design aspects of a three-cycle engine are evaluated. 8 refs. In German.

McCune, J. E.; Kerrebrock, J. L.
NOISE FROM AIRCRAFT TURBOMACHINERY
In Annu Review Fluid Mech, v 5, Ed by M. VanDyke

Reduction of noise in modern, high-bypass turbofans is discussed, and prediction of noise levels from blading geometry is emphasized. The connection between noise production and performance measured in terms of thrust/unit of airflow and thrust/unit of engine weight is examined. Jet and turbomachinery acoustical efficiency is considered, along with the importance of specific thrust. Noise sources and suppressors in supersonic jets are described, and rotor and compressor noise is analyzed.

Plucinsky, J. C.
"QUIET" ASPECTS OF THE PRATT & WHITNEY AIRCRAFT JT150 TURBOFAN
SAE Prepr 730289 for Meet Apr 3-6, 1973

This paper describes the engine design details of the Pratt & Whitney JT15D-1 Engine as related to noise generation. Design principles and factors contributing to the very low noise levels on the Cessna Citation aircraft are illustrated. Noise testing experiences and data from static tests on the United Aircraft of Canada Ltd. (UACL) flight test aircraft and from both static and flight tests on the Citation aircraft are discussed. Lessons learned from these tests and some future probabilities are outlined. 12 refs.

Tucker, R. H.; Nelson, M. D.; Gregg, G. E.; Palmer, F. I.
DEVELOPMENTAL DESIGN, FABRICATION, AND TEST OF ACOUSTIC SUPPRESSORS FOR FANS OF HIGH BYPASS TURBOFAN ENGINES.
NASA Contract REP CR-2338, Jan 1974

The acoustic design goal was a 10 dB reduction in effective perceived fan noise levels during takeoff and approach, through improved nacelle design. The acoustic design goal for each nacelle was 15 dB reductions in perceived fan noise levels from the inlet and fan duct. A three-ring inlet, one ring fan duct design using a broadbased acoustic lining, provided the best performance. Estimates of peak attenuation are 12.8 and 9.4 EPN dB in the inlet and fan duct radiated noise, respectively. 15 refs.

Noise Reduction Progress -

Blumenthal, V. L.; Huntington, W. S.; Streckenbach, J. M.
NOISE-REDUCTION RESEARCH AND DEVELOPMENT: 1972 PROGRESS
Boeing Company, Com Airplane Divn, Docu D6-60199, Mar 1973

Noise reduction at Boeing Commercial Airplane Company is discussed and important areas that need urgent attention and adequate funding to ensure a continued improvement in the community noise situation are highlighted. Specific progress in the research and development of noise control in the low-bypass-ratio turbofan fleet (including the 727, 707 and 737 airplanes) and the 747 airplane is described. Advances have been made in the technologies of quieter engine design and the acoustic treatment of engine installations to attenuate engine-generated noise. Recent studies and flight tests of large commercial airplanes strongly indicate that a new constraint must be considered, that of airframe noise for at least the approach condition.

Siddon, T. E.
JET NOISE RESEARCH--PROGRESS AND PROGNOSIS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, 1972, p 2-3

The evolution of turbofan engine technology is outlined and research on noise generation mechanisms and noise reduction is reviewed. Diagnostic techniques and instrumentation are described, and the fluid dynamics of noise production by subsonic jet engines is discussed.

Tedrick, R. N.; Heldenbrand, R. W.
PROGRESS IN THE DEVELOPMENT OF OPTIMALLY QUIET TURBOFAN ENGINES AND INSTALLATIONS
SAE Paper 730287 for Meet Apr 3-6, 1973

A program, under the sponsorship of the U.S. Air Force Aero Propulsion Laboratory, is now under way to provide the computational tools necessary to predict noise signatures for small turbopropulsion engines and to design attenuation equipment as required to meet specific low noise goals. The 24-month program, scheduled for completion in August 1973, involves the analysis of turbine engine noise prediction and attenuation methods, as well as the experimental verification of these analyses with full scale hardware. This paper reviews the methodology development phases and examines acoustical data from bare and attenuated engine tests.

Advanced Engines -

Beheim, M. A.; Antl, R. J.; Povolny, J. H.
ADVANCED PROPULSION CLEANER AND QUIETER
Astronaut Aeronaut, v 10 n 8, Aug 1972, p 37-43

Advanced propulsion could make an airliner much more acceptable to the community around the airport and still push it to Mach 0.98 cruise speed at little extra cost. Problems of acoustical noise and engine emissions are discussed and solutions proposed both through improved aerodynamics design and the use of improved materials. 2 refs.

Gerend, R. P.; Roundhill, J. P.; Welliver, A. D.
ENGINE CYCLE CONSIDERATIONS FOR FUTURE TRANSPORT AIRCRAFT
SAE Prepr 730345 for Meet Apr 24-26, 1973

Recent noise technology advancements have provided an increased understanding of true engine noise "floor" levels. This has led to changes in necessary engine cycle requirements for low-noise commercial airplanes. Updated prediction techniques for the core and jet noise sources are described, and lining technology improvements are reviewed. Core engine noise rather than jet noise may determine the noise floor for engines with bypass ratios much above BPR = 5-7. Thus, the ability to reach very low noise levels with higher bypass ratio engines may not be as great as previously predicted.

BENEFITS OF ADVANCED PROPULSION TECHNOLOGY FOR THE ADVANCED SUPERSONIC TRANSPORT
SAE Prepr 730896 for Meet Oct 16-18, 1973

This paper will cover the promising propulsion systems including variable cycle engine concepts for long range supersonic commercial transport application. The benefits of applying advanced propulsion technology to solve the economic and environmental problems will be reviewed. The advanced propulsion technologies to be covered will be in the areas of structures, materials, cooling techniques, aerodynamics, variable engine geometry, jet noise suppressors, acoustic treatment, and low emission burners. The results of applying the advanced propulsion technology will be presented in terms of improvement in overall system takeoff gross weight and return on investment.

Kramer, J. J.
NASA QUIET ENGINE
SAE Paper 710774 for Meet Sept 28-30, 1971

Development of the high-bypass ratio engine with its low jet noise signature, improved understanding of the fan noise generation process and development of nacelle acoustic lining technology have all contributed to the feasibility of reducing noise levels associated with the 707/DC8 aircraft by approximately 15 to 20 PNdB 13 refs.

Jet Noise

Directivity -

Chu, W. T.; Petersen, R. A.; Kao, K.
DIRECTIVITY OF JET NOISE
J Acoust Soc Amer, v 51 n 3, Part 1, Mar 1972, p 830-832

Communication to the editor shows how Ribner's proposed basic directivity of jet noise and also the modified Lighthill's convection effect can be used to predict the acoustic power of subsonic jets from a single point intensity measurement at 90 deg from the jet axis. The prediction was very good from low subsonic speeds to near sonic speeds for a 2-in. diam model jet.

Ribner, H. S.; MacGregor, G. R.; Lam, H.
BASIC DIRECTIVITY OF JET NOISE WITH IMPROVED CORRECTION FOR REFRACTION

In an earlier work of Grande, experimental jet noise polar plots were corrected for refraction (by experiment) and for convection (by theory) to yield the experimental basic directivity in narrow frequency bands. The experimental correction for refraction at each frequency was obtained from the difference in the directional patterns of a point source placed in the air jet with jet off and jet on. Before refraction, this point source will produce a spherical directional pattern, but the narrow-band jet noise will have an elongated pattern owing to convection. It was realized belatedly that the refractive change in intensity at corresponding angles cannot be taken as the same for the two different initial polar patterns. There is some violation of energy conservation. To avoid this error, later unpublished measurements by Mac Gregor were reworked by Lam, incorporating a correction to the refraction effect measured with the point source. The correction was specified by an assumed functional form as a polar plot; the amplitude was then dictated by the requirement of conservation of energy. The measured jet noise data processed along the lines of Grande, led to much improved agreement between experiment and theory.

Measurement -

DeBelleval, J. F.; Perulli, M.; Gauffre, G.
COMPUTATION OF THE SOUND FIELD OF A JET FROM CHARACTERISTIC TURBULENCE PARAMETERS MEASURED BY CROSSED BEAM TECHNIQUES
Opto-Electron, v 5 n 1, Jan 1973, p 65-69

The sound field radiating from a jet is strongly dependent upon the turbulence in the jet. To describe the sound sources in a hot jet, a method has been developed, based upon the measurement of infrared radiation of the jet, and a hybrid processing of the measured signal which enables the computation of characteristic properties of the turbulence at various points inside the jet. From these quantities the acoustic far field can be mapped, as a function of the polar distribution of the spectrum, the turbulence intensity and the total sound pressure field. 15 refs.

Salant, R. F.; Wu, J.H.T.; Handa, H.; Sorrow, J. W.
HOLOGRAPHIC STUDY OF THE DISTURBANCES GENERATING SUPERSONIC JET NOISE
Acous Soc of Amer New York J, v 53 n 1, 1973, p 291-392

Optical holography has been used to study the noise generating disturbances within supersonic N and He laboratory scale tests. Mach angle measurements indicate that the average convection velocity of such disturbances is 77 percent of the jet velocity for the N jet in the Mach number range of 2.8 to 3.4, and is 67 percent of the jet velocity for the He jet in the Mach number range of 1.5 to 3.0. The length scale of the disturbances in the N jet has been found to contain a primary peak at 0.20 to 0.45 jet diameters. The amplitude of the secondary peak, relative to the primary peak, increases in the downstream direction. In addition, the real length scales shift upwards in the downstream direction.

Salant, R. F.; Zaic, G. F.; Kolesar, R. R.
HOLOGRAPHIC STUDY OF THE MACH WAVE FIELD GENERATED BY A SUPERSONIC TURBULENT JET
Noise and Vibr Control Engr Conf, Proc. 1972, p XV-XXV

Holographic interferograms of supersonic cold air jet indicate the dominant form of radiation from such a jet is Mach wave radiation. The conical wave fronts are clearly visible, extending from the edge of the supersonic core into the ambient fluid. They appear to originate from disturbances at the edge of the potential core, and are not observed to be generated downstream of the tip of the potential core. Experiments in which a wedge was inserted into the subsonic mixing region of the jet, indicate that region plays little, if any, role in the Mach wave generation process.

Crossflow-

Cole, J. E. III
INFLUENCE OF A CROSSFLOW ON JET NOISE
ASA Contr Rep CR-2169, Nov 1972

The acoustic field which is generated by a circular jet in the presence of a low speed crossflow is calculated. The solution is obtained for a quadrupole source located in a uniformly moving acoustic medium. Ribner's work on straight jets is used to model the flow in the turbulent crossflow jet. the movement of the acoustic medium results in the acoustic intensity being further upstream of the jet flow than at an equal distance downstream. A summary is also presented of the analysis for the acoustic intensity of a crossflow jet which is in motion through a stationary acoustic medium. This analysis is applicable to the noise generated by the lift jet of a V/STOL aircraft under takeoff or landing conditions. The results of these two configurations provide a comparison of the directional distribution of acoustic intensity measured in a wind tunnel test of a crossflow jet and in a corresponding flight test. 14 refs.

Cole, John E. III
NOISE CHARACTERISTICS OF A TURBULENT CROSSWIND JET
AIAA J, v 12 n 2, Feb 1974, p 198-202

The turbulent flow which results when a circular jet issues into a crosswind is a noise source which is encountered during takeoff and landing of certain types of V/STOL aircraft. The acoustic intensity of the noise from this flow is calculated by extending a previous freejet model to those crosswind jets for which the ratio of jet velocity to crosswind velocity is between 6 and 10. The extended model accounts for the noncircular cross section. The shortened potential core region, and the flow characteristics in the initial mixing region of the crosswind jet. The result of this analysis is an expression for the directivity function of the acoustic intensity from a crosswind jet of a V/STOL aircraft in flight. 11 refs.

Subsonic Jet Noise -

Bordovishyn, y. a.
COMPACT SUBSONIC GAS JET AERODYNAMIC NOISE SUPPRESSOR
Sov Aeronaut, v 16 n 1, 1973, p 83-84

Results are presented of full scale tests of a compact noise suppressor for a subsonic jet which provides reduction of the noise level over the entire audio frequency range. The suppressor operating principle and construction are described. Use of the suppressor is recommended for reducing the noise level of the exhaust gas jet of marine gas turbine installations, gas turbine electric generation stations, and gas turbine engine test stands. 2 refs. 026751

Bushnell, K. W.; Ahuja, K. K.
AN EXPERIMENTAL STUDY OF SUBSONIC JET NOISE AND COMPARISON WITH THEORY
J Sound Vibr, v 30 n 3, Oct 8, 1973

Measurements of the noise field from three subsonic cold air jets are presented. The tests were conducted in the anechoic chamber of the National Gas Turbine Establishment, Pyestock, England, on a test rig with a very large contraction ratio (maximum, 250:1; minimum, 70:1) and with an air supply system which produces a jet having a low turbulence level just upstream of the nozzle exit and whose noise is dominated by pure jet mixing noise. Comparison of the results is made with the theory by analyzing them in detail by determining both the jet velocity dependence and the directivity of the intensity of the radiation in 1/3 octave bands at particular values of the doppler corrected Strouhal frequency.

Chu, W. T.; Laufer, J.; Kao, K.
NOISE SOURCE DISTRIBUTION IN SUBSONIC JETS
Inter-Noise 72, Intl Conf on Noise Control Engr. Proc. 1972, p 2-4

A directional microphone system based on the imaging principle of a spherical concave reflector was used to quantitatively determine noise source distribution in subsonic jets. Higher frequency noise is generated by sources located close to the nozzle exit. Numerical improvement is obtained by spatial resolution of the directional microphone system at lower frequencies.

Crighton, D. G.
EXCESS NOISE FIELD OF SUBSONIC JETS
J Fluid Mech, v 56, part 4, Dec 28, 1972, p 683-694

The sound field generated by the interaction of spatial instabilities on the shear layer shed from a duct with the nozzle lip is studied. It is shown that the intensity varies with direction theta from the exhaust and with the subsonic exhaust speed U according to I similar $U^6(1-\cos\theta)^2$ and I similar $U^6\sin^2\theta$ for the axisymmetric and first aximuthal (sinuous) modes respectively. The first of these results is interpreted in terms of monopole and dipole sources at the exit plane, representing the acoustic effect of fluctuating mass flow and axial thrust across the exit plane, and the second in terms of a transverse dipole at the exit plane, corresponding to fluctuations in cross stream thrust. 13 refs.

Davies, P.O.A.L.; Ko, N.W.M.
THE NEAR FIELD WITHIN THE POTENTIAL CONE OF SUBSONIC COLD JETS
J Fluid Mech, v 50 n 1, Nov 15, 1975, p 49-78

The components of the near pressure field in the potential cone of a subsonic circular turbulent jet in which the potential flow condition exists within the first four and a half diameter downstream appear to be moving with a phase velocity equal to the local speed of sound. The direction of propagation is roughly normal to the shear layer surrounding the cone. Some components of the hot wire signal can be associated with the jet structure as a simple complex source, while others are related to the local characteristics of turbulence. Differences in the characteristics of the pressure field within the potential cone exist between the vortex generated noise at very low jet velocity and the eddy generated noise at higher velocity.

Maestrello, L.; McDaid, E.
ACOUSTIC CHARACTERISTICS OF A HIGH-SUBSONIC JET
AIAA J, v 9 n 6, June 1971, p 1058-66

The acoustic source regions of a subsonic cold jet were traced as far as the periphery of the jet by means of the pressure field on a plane rigid surface located in the vicinity of the jet. The centers of these regions were determined to be from 4 to 18 diam downstream of the exit. Additional measurements were made of flow variables within the jet. From these measurements, the downstream kinetic energy dissipation rate was calculated. Finally, the acoustic radiation characteristics of several simple nozzle configurations were measured. Results indicate that only limited reductions in total sound power resulted. 35 refs.

Munin, A. G.; Shchepochkin, M. A.
ACOUSTIC POWER SPECTRUM OF A SUBSONIC JET
Sov Phys Acous, v 18 n 2, Oct-Dec 1972, p 241-245

The spectral distribution of the radiated acoustic power from an axisymmetric choked jet is investigated. Expressions are derived for the noise spectral in the initial and main segments of the jet. The solution is extended to the case of an arbitrary segment of the jet from the nozzle orifice to a particular fixed segment. The results can be used for calculations of the emission spectrum for noise from any segment of a jet between two fixed cross sections. 5 refs.

Tanna, H. K.
ON THE EFFECT OF SWIRLING MOTION OF SOURCES ON SUBSONIC JET NOISE
J Sound and Vibr, v 29 n 3, Aug 8, 1973, p 281-293

The general result for the sound field of a point acoustic stress in arbitrary motion is applied to study the effect of uniform circular source motion on the farfield sound radiation from a randomly oriented point quadrupole of random time variation. By using the moving source approach, closed form results are obtained for the overall radiation directly, without involving the radiation spectrum. A uniform axial motion is then superimposed and the sound field of a point quadrupole in helical motion is evaluated by applying retarded time transformations to the circular motion results. The effects of acceleration of the sources, due to steady convection in a helical path, on the familiar linear motion results for subsonic jet noise are established.

Yu, J. C.
FAR NOISE FIELD OF A SUBSONIC AIR JET
Acous Soc of Amer New York J, v 53 n 1, 1973, P 291-392

A far-field noise survey, conducted in the open field, was made for a 2 in. circular subsonic cold air jet. The exit velocity range investigated varied from 350 to 800 ft/sec. The contoured converging nozzle used had a contraction ratio of 50. In order to eliminate possible upstream acoustic contamination of the jet noise, a blow-down technique was used to generate jet flow with a large acoustically treated settling chamber. Results are presented in the form of overall and spectral directivity, power spectrum, total power radiated, and their dependence on mean flow parameters. Correlation was made with the existing theories of subsonic jet noise.

Supersonic Jet Noise -

Barna, P. S.
PERFORMANCE AND NOISE GENERATION STUDIES OF SUPERSONIC AIR EJECTORS
NASA Contract Report CR-2056, Jun 1972

Experimental investigations are conducted to determine the aerodynamic performance and noise generation characteristics of five ejectors having subsonic secondary flow. Primary nozzles with equal exit area for Mach numbers 1, 1.5, 2, 2.5 and 3 produces a variety of noise and pumping effects. The pumping capacity, specific power and noise generation of the Mach 1 nozzle is the highest and its mass augmentation is the lowest among the nozzles tested. The Mach 3 nozzle is found superior in mass augmentation and it also produces the lowest noise, however its pumping capacity and specific power was the lowest. 15 refs.

Dosanjh, D. S.; Yu, J. C.; Abdelhamid, A. N.
REDUCTION OF NOISE FROM SUPERSONIC JET FLOWS
AIAA J, v 9 n 12, Dec 1971, p 2346-2353

Acoustic characteristics and flow behavior of interacting coaxial supersonic jets have been investigated experimentally. A number of arrangements of inner and outer coaxial nozzles were used. Far field acoustic measurements and preliminary near field measurements were made. Substantial reductions in both peak sound pressure and total radiated power were obtained over a range of operating conditions of coaxial jet flows. Spark-shadowgraphs recorded at these operating conditions revealed consistent appearance of a characteristic pattern of shock structure which effectively eliminates usual repetitive shock cells associated with supersonic jet flows. Corresponding velocity profiles deduced from pilot-pressure surveys of coaxial jet flows indicate that large mean shear at the inner boundary of the outer annular jet as well as mixing are favorably modified owing to interaction of inner and outer jet flows. Dependence of measured noise reduction on observed flow changes is discussed.

Liu, J.T.C.
NOISE RADIATION FROM TURBULENT SHEAR LAYER INSTABILITY WAVES IN SUPERSONIC JET EXHAUSTS
Noise and Vibr Control Engr Conf, Proc, 1972, p XV-XXV

Supersonic exhaust flows are investigated. It is contended that the Mach wave radiation field is generated by supersonically traveling waves, rather than randomly occurring and disappearing eddies, which are inherent in the dynamically "unstable" supersonic turbulent free shear flow. The mechanisms which are responsible for the volution of these waves in a developing turbulent free shear flow are discussed. The acoustic energy flux normal to the shear layer first increases and then decreases in the streamwise direction. The contributions from the higher Strouhal number waves occur over a squashed streamwise distance closer to the start of the free shear layer, and from the lower Strouhal number waves over a stretched out streamwise distance further downstream. The Strouhal number being the wave frequency made dimensionless by the exit velocity and the initial boundary layer thickness.

Nagamatsu, H. T.; Sheer, R. E. Jr; Gill, M. S.
CHARACTERISTICS OF MULTITUDE MULTISHROUD SUPERSONIC JET NOISE SUPPRESSOR
IAA J, v 10 n 3, Mar 1972, p 307-313

Supersonic jet noise suppressor with 191 tubes and 191 hexagonal shrouds was investigated at jet Mach numbers of 1.4 and 0.71. The effects of the length of the multishrouds and the location of the shroud leading edge from the tube exits were determined. Comparison is made with the equivalent 1-9/16 in. diam convergent nozzle, and the acoustic data were analyzed by means of a supersonic jet noise theory. The overall sound power level reduction and the percentage thrust loss for various multishroud configurations were determined. 9 refs.

Pao, S. P.
GENERALIZED THEORY ON THE NOISE GENERATION FROM SUPERSONIC SHEAR LAYERS
J Sound Vibr, v 19 n 4, Dec 22, 1971, p 401-410

The present paper, generalization to Phillips' theory, is presented. Both Mach wave radiation and non-Mach noise radiation mechanisms are considered The range of validity of Phillips' theory has been expanded to include the low supersonic and transonic ranges. It is found that the low frequency noise is refracted by the mean flow while the high frequency noise is refracted and attenuated by the mean flow. For each given noise frequency, the source is limited to a finite layer of the jet. Incidentally, the major portion of the noise spectrum can be analytically classified as high frequencies. The noise generation mechanisms in a supersonic jet are found to differ from those in a subsonic jet in general. 14 refs.

Yu, J. C.: Dosanjh. D. S.
NOISE FIELD OF A SUPERSONIC MACH 1.5 COLD MODEL JET
J Acous Soc Amer, v 51 n 5, part 1, May 1972, p 1400-1410

Systematic surveys were made of near and far noise fields for a supersonic cold model jet with nozzle design for Mach 1.5. Experiments showed that the strongest source for the shock-free jet was located in the region between the laminar core tip and the supersonic core tip. For the underexpanded jet the strongest source was near the middle of the flow region containing repetitive shock waves.

Jets with Combustion -

Abdelhamid, A. N.; Harrje, D. T.; Plett, E. G.; Summerfield, M.
NOISE OF HIGH SPEED JETS WITH ROUGH COMBUSTION
Acous Soc of Amer, New York, J, v 53 n 1, Jan 1973, p 291-392

An experimental program to demonstrate the effect of unsteady combustion processes in a combustion-augmented jet flow is described. Characteristics of noise for several combustors, having different flame holders and several lengths, operating in a jet temperature range from 1100°C to 1500°C and a jet Mach number range from 0.2 to 0.35 (jet exit velocity ranging between 400 and 800 ft/sec) are presented. Data were collected from 6 B&K 1/4 in. microphones positioned at an angular separation of 15 deg in a quadrant of 50 ft radius from the 2-in. diam nozzle exit. Kistler Type 601 pressure transducers are mounted in the duct wall of the combustor which is held on a Pylon 12 ft above the ground. A directivity pattern with a nearly circular pattern, which has a peak in the vicinity of 45 to 60 deg from the jet axis is shown. Comparison of internal pressure fluctuations with the far field noise shows many similarities in the spectrum, an observation which is verified by the strong cross correlation between the two signals. Combustor and flame holder geometry are found to affect the level and frequency content of the noise.

NOISE CHARACTERISTICS OF COMBUSTION AUGMENTED JETS AT MIDSUBSONIC SPEEDS
AIAA J, v 12 n 3, Mar 1974, p 336-347

Noise generation by a subsonic flow discharging from a combustion chamber is examined with regard to the relative importance of combustion as a source of noise in such a flow system. Measurements of pressure fluctuations inside the combustor are compared with far field noise measurements by direct cross correlation. The corss correlations and derived cross spectral densities verify that much of the noise originates inside the combustor. A fluid mechanic perturbation model is used to predict exit plane velocity fluctuations due to internal pressure fluctuations. This unsteadiness at the exit plane is assumed to behave as an acoustic monopole which radiates to the far field. Far-field noise levels estimated on this basis are in good agreement with measured values. The overall noise level from the combustor/jet is found to be 10 to 20 dB higher than for an equivalent clean, cold jet at the same exit velocity in the range of 500 to 700 fps. 13 refs.

Prediction and Correlation -

Ahuja, K. K.
CORRELATION AND PREDICTION OF JET NOISE
J Sound Vibr, v 29 n 2, July 22, 1973, p 155-168

Measurements of subsonic jet noise made on a model jet rig in an anechoic chamber are presented. Jet noise spectra for three nozzles of diameters 2.84, 2.4 and 1.52 in. were obtained. Care was taken to ensure that unwanted noise from sources such as valves and ducting upstream of the nozzle were insignificant compared with the jet mixing noise. Data points were collapsed onto one curve by normalizing the 1/3 octave and overall sound pressure levels for the theoretical parameters from Lighthills' theory and by presenting empirical schemes to collapse the data for all the angles and the frequencies. The schemes presented predict noise accurately for cold and clean jets.

Bushell, K. W.
SURVEY OF LOW VELOCITY AND COAXIAL JET NOISE WITH APPLICATION TO PREDICTION
J Sound Vibr, v 17 n 2, July 22, 1971, p 271-82

Noise correlations are given which show that at low jet velocities, the low frequency exhaust noise which is commonly referred to as jet noise, emitted from the fan stream of a turbofan engine is considerably lower in level than that from the (HTO) center stream. From this result, a new prediction procedure for coaxial jet noise of turbofan engines is then developed, 18 refs.

Lee, H. K.; Ribner , H. S.
DIRECT CORRELATION OF NOISE AND FLOW OF A JET
J Acoust Soc Amer, v 52 n 5, part 1, Nov 1972, p 1280-1290

Measurements show a direct correlation between the flow and noise of a jet. Two kinds of correlation explored were the broadband turbulence signal with the broadband acoustic signal and the narrowband filtered turbulence signal with the narrowband filtered acoustic signal. The correlations were analyzed in terms of an extension of Proudman's form of Lighthill's integral for aerodynamic noise.

SIMPLE PRESSURE SOURCE MODEL OF JET NOISE
J Acous Soc Amer, v 51 n 1, part 2, Jul 1972, p 399-412

An analytical and experimental study is made of the simple-pressure-source model of the sound radiated by a sonic jet. An input-output relation is derived for the ratio of the radiated sound-power frequency spectrum to the jet-pressure spectrum. Measurements provide jet-pressure spatial, spectral, and cross-correlational data for a small scale, cold Mach-1 jet. Implications of the model for noise suppression in aircraft engines are discussed. 32 refs.

Screened Jets

Arndt, R.E.A.; Tran, N. C.; Barefoot, G. L.
FURTHER STUDIES OF THE AEROACOUSTICS OF JETS PERTURBED BY SCREENS
Acous Soc Amer, New York J, v 52 n 1, July 1972, p 112-188

The placement of a screen across the exit plane of a jet nozzle results in a substantial reduction in noise intensity over what would be realized with an equivalent unperturbed jet. In the past, the general features of this phenomenon were analyzed experimentally utilizing both farfield pressure measurements and velocity (hot-wire) measurements. The measurement of nearfield pressure, along with a more extensive program of hot-wire measurements, was investigated. Nearfield pressure measurements were made with a static pressure probe. These data are used to determine the distribution of sound source in the screen perturbed jet. The nearfield pressure measurements give comparable information about the effect of the screen on the acoustics sources. Extensive hot-wire data indicate that there is a major change in the characteristics of the flow field of a screen perturbed jet. The potential core in the mixing region extends farther downstream and turbulent intensities are reduced to a lower level. The strength of the quadrupole sources (assumed proportional to Reynolds stresses) is changed from a maximum value of 0.011 to less than 0.008 near the center of the mixing region. The acoustic power is proportional to the fifth power of the longitudinal scale of the flow.

Arndt, R.E.A.; Tran, N. C.; Barefoot, G.
TURBULENCE AND ACOUSTIC CHARACTERISTICS OF SCREEN PERTURBED JETS
AIAA J, v 12 n 3, Mar 1974, p 261-262

A previous study of noise reduction by placing a screen across a jet flow is extended by attempting to relate the aeroacoustics of the perturbed jet with its turbulent structure. The investigation consisted of three phases: a) a study of various configurations to determine if the effect could be optimized, b) a detailed investigation of the acoustic signal from the best configuration, and c) measurement of the flow characteristics of perturbed and unperturbed jets to determine the mechanism of attenuation. 6 refs.

General Group -

Anon
ESTIMATION OF NEARFIELD SOUND PRESSURE LEVELS DUE TO JET NOISE
Eng Sci Data Unit Item 72002, Jan 1972

Charts and equations provide data for estimating sound pressure levels in the vicinity of a gas turbine jet and estimation of acoustic fatigue life of structure near a jet exhaust. Estimation of cabin noise levels is described. 5 refs.

Antonov, A. N.; Shalafv, S. P.; Yudelovich, M. Y.
VLIYANIF DISKRETNOI SOSTAVLYAYUSCHEI AKUSTICHESKIKH KOLEBANII NA TECHNIE V NEARASCHETNOI SVERKHZVUKOVOI STRUE. (INFLUENCE OF THE DISCRETE COMPONENT OF ACOUSTIC OSCILLATIONS ON THE FLOW IN AN OFF-DESIGN SUPERSONIC JET).
IZV Akad Nauk (SSSR), Mekh 7HIDK Gaza n 4, July-Aug 1973, p 142-148

Results are given of an experimental investigation of the flow in an axisymmetrical off-design air jet streaming out of a sonic or supersonic nozzle into a submerged space. It is shown that reflecting boards positioned in the external field at the nozzle end face strengthen the discrete component of the acoustic field. Reduce the length of the initial jet sector and its range characterized by the dependence of the velocity head at the jet axis on the distance to the nozzle end face. The ranges of off-design flow are determined for which there exists a discrete component in the jet with the reflecting boards at different values of the Mach number M at the nozzle end face. It is shown experimentally that by appropriately selecting the position of the axisymmetrical board or mutual position of half-boards it is possible to influence the jet range and change the value of the discrete component. In Russian.

Banerian, G.
JET NOISE - THE STATE OF THE ART
Sv Sound Vibr, v 8,n2, Feb 1974, p 30-34

A reivew about the jet noise generation, levels, and abatement is presented. 8 refs.

Chan, Y. Y.
SIMPLE MODEL OF SHOCK CELL NOISE GENERATION AND ITS REDUCTION
Natl Res Council Can, Aeronaut Report LR-564, Oct 1972

Based on the data of nearfield surveys of the sound pressure from a choked jet, a simple model is proposed for the mechanism of the screech generation. A convected wave propagates downstream along the jet boundary and is modulated by its interaction with the shock-expansion waves of the jet. These interactions generate strong dipole radiations. Using this model, an excellent reproduction of the essential features of the experimental results is obtained. By preventing the formation of shock waves inside the jet, the strong dipole radiation and hence the screech noise can be eliminated. Design data for perforated nozzles to achieve full expansion of the jet are provided. This avoids the mechanical complication of an adjustable convergent-divergent nozzle. 10 refs.

Chu, W. T.
MOVING-FRAME ANALYSIS OF JET NOISE
J Acous Soc Amer, v 53 n 5, May 1973, p 1439-1440

Communication to the editor shows how utilizing the spectral representation, a simple mathematical procedure can be used to derive the moving-frame formulation jet noise.

Hoch, R. G.; Duponchel, J. P.; Cocking, B. J.; Bryce, W. D.
STUDIES OF THE INFLUENCE OF DENSITY ON JET NOISE
J Sound Vibr, v 28 n 4, June 22, 1973, p 649-668

Two independent research programs on model convergent nozzles were conducted with advanced research facilities to study the effect of density by varying the jet temperatures at velocities from 150 to 800 m/sec. Data for the sound power and peak noise levels are presented with a range of spectra and directivity patterns. At high jet velocities the jet noise decreases with decreasing densityt at low velocities the trend is reversed. The noise data can be empirically correlated by using a velocity-dependent function of the fully expanded jet density.

Lee, B.H.K.; Westley, R.
EFFECTIVE SOURCE DISTRIBUTION IN A CHOKED SCREECH JET
Natl Res Counc Canada, Aero Report LR-548, May 1971

Using experimental measurements of the sound pressure and phase in the near field of a choked screech jet, a method is proposed for computing the effective source positions, their strengths and phases. Two models are considered. The first assumes a distribution of point sources along the jet axis and the second assumes ring sources along the jet boundary instead. A technique of minimization due to Powell is used and a solution is obtained when the sum of squares reaches a minimum. Results for a choked jet at a screech frequency of 3170 c/s are presented. 19 refs.

Lyutyi, V. A.; Novikov, L. V.; Shvets, A. I.
PUL'SATSII DAVLENIYA V KOL' TSEVKYH SOPLAKY (PRESSURE PULSATIONS IN ANNULAR NOZZLES)
Izv Akad Nauk (SSSR) Mekh Zhidk Gaza N 5, September-October 1973, p 126-132

Fluctuations of base pressures in the flow of jets depend on many factors. The most important of them are: quasi-stationary restructuring of the flow in annular jets or multinozzle arrangements, acoustic radiation of the jets and the nonstationary character of the flow in the BSE region. In this article, results are presented of investigations into the pulsations of base pressure at the end of an annular nozzle due to acoustic radiation of supersonic jets. Experiments on slot nozzles with the outer diameter equaling 110 mm and the inner diameter 88 mm are described. 14 refs. In Russian.

Manson, L.; Burge, H. L.
JET-NOISE REDUCTION THROUGH LIQUID BASE FOAM INJECTION
J Acous Soc Amer, v 50 n 4, part 1, Oct 1971, p 1067-74

An experimental study was made of the sound-absorbing properties of liquid base foams and of their ability to reduce jet noise when injected into the periphery of the exhaust jet. Protein, detergent, and polymer foaming agents were used in water solutions. Sound emitted by subsonic and supersonic jets was reduced up to 10 PNdB. 10 refs.

Michalke, A.
AN EXPANSION SCHEME FOR THE NOISE FROM CIRCULAR JETS
Z Flugwiss, v 20 n 6, June 1972, p 229-237

An expansion scheme for the noise from circular jets is derived which takes account of the geometrical configuration of circular jets and of recent observations of jet turbulence. It is found that only a relatively small number of turbulence components, characterized by their frequency and azimuthal wave number, contribute essentially to the far field noise. A jet thickness parameter and a convection parameter strongly influence the sound radiation. Most of the phenomena of jet noise known from experiments can be explained by this very general solution. Theorectical results derived previously by means of the "Eddy model" of turbulence are also contained in the present solution. Both these results are very special, since they were obtained under very restricting assumptions. 21 refs.

Morris, P. J.; Richarz, W.; Ribner, H. S.
REDUCTION OF PEAK JET NOISE USING JET REFRACTION
J Sound Vibr, v 29 n 4, Aug 22, 1973, p 443-455

The directivity pattern of sound generated by a subsonic jet exhibits a peak at angles between 15 and 45 deg to the jet axis, decreasing to a minimum on the jet axis. Theoretical and experimental investigations previously demonstrated that this minimum is due to refraction of sound by the jet flow. The effect of the introduction of a second jet of smaller exit area near to the main jet is considered. The small jet imposes its own heart-shaped directivity pattern on that of the first jet. Alteration of the angle between the two jets leads to a reduction in the peak sound level. Directivity patterns for unfiltered and filtered measurements are presented for changes in the jet velocities and temperature ratios. Calculations of the perceived noise level radiated by one and two jets of larger scale are made. The changes in ground area effected by various noise levels are given for an aircraft taking off and using a number of alignments of auxiliary engines to alter the pattern of radiated sound.

Petrick, H. K.
WECHSELDRUCKMESSUNGEN AN PILZDUESENSTROEMUNGEN HINSICHTLICH DYNAMISCHER BEANSPRUCHUNG VON HAUTSTRUKTUREN WIEDERVERWENDBARER TRAEGERRAKETEN. (FLUCTUATING PRESSURE MEASUREMENTS OF PLUG NOZZLE FLOW FOR DESIGN OF SKIN STRUCTURES ON REUSABLE ROCKET ENGINES).
Raumfahrtforschung v 17 n 5, September - October 1973, p 235-246

Experiments with models of plug nozzles are carried out to determine the acoustic parameters of the plug nozzle flow. The overall fluctuating pressure level and its power spectrum of the flow at the base of truncated plug nozzle are measured and classified against standards. The noise propagation to the surrounding air generated by the nozzle jet is also measured. 21 refs. In German with English abstract.

Plett, E. G.; Summerfield, M.
ESTIMATES OF THE CONTRIBUTION OF JET ENGINE EXHAUST NOISE MADE BY INTERNAL SOURCES
Acoust Soc of Amer, NY, J, v 53 n 1, January 1973, p 291-392

The flow unsteadiness generated inside a turbojet engine by unsteady flow interactions with struts as well as the unsteadiness generated by nonsteady combustion processes may be significant sources of noise in high-bypass aircraft engines. By treating the jet exhaust plane as a surface bounding the otherwise free jet, a surface integral of the appropriate turbulence quantities over the exit plane of the nozzle yields the contribution from the internal sources. Monopoles, dipoles, and quadrupoles have been used to characterize the fluctuation at the exit plane. Source strengths corresponding to turbulence intensities ranging from 1 percent to 20 percent are used in calculation. If the exit plane and shear region have the same turbulence intensity, then a single exit plane monopole source could produce more noise than 10^3 shear region quadrupoles over the entire subsonic jet Mach number range, and if the exit plane was filled by a single dipole rather than monopole source, it would be the dominate source to Mach numbers of about 0.6.

Richter, G.
ETUDE DES SOURCES DE BRUIT DE JETS CHAUDS. (STUDY OF HOT JET FLOW NOISE SOURCES).
Entropie, v 9 n 51, May-June 1973, p 55-59

According to the theory of Lighthill the noise emission of a gaseous jet is a function of the turbulence characteristics of the flow. Several theoretical and experimental methods of determining these characteristics have been developed which are generally applied to jets whose temperature is close to ambient temperature. Noise measurements of low speed jets (jets of by-pass engines) as well as observations made in testing silencers for high speed jets have shown that temperature effects of hot jets are not negligible. The development of a method adapted to hot jets has been undertaken. It consists in the determination of the space-time-parameters of the turbulence by means of the measurement of the infrared emission from the jet, and the introduction of those data into a computer program for the calculation, based on Lighthill's theory, of the far noise field.

Rudd, M. J.
A NOT ON THE SCATTERING OF SOUND IN JETS AND THE WIND
J of Sound and Vibr, v 26 n 4, Feb 22, 1973, p 551-560

The theory of the scattering of sound by turbulence, as developed by Tatarski and modified by Monin, is used to calculate the scattering cross sections of two turbulent flows, jets and the wind. Strong scattering can occur under normal conditions. The strength of the scattering increases rapidly with the frequency of the sound and the length scale of the turbulence. The importance of acoustic scattering is discussed in connection with methods of jet noise reduction and sound attenuation by the wind.

Thomson, A. G. R.
ACOUSTIC FATIGUE DESIGN DATA EM DASH 1.
Agardograph, n 162 May 1972

Due to wide band high intensity noise, jet exhausts can cause structural fatigue failure in adjacent materials. This preliminary report presents design criteria on acoustics fatigue, sound pressure levels data, natural frequencies of skin-stringer structures and plates and an estimate of RMS stress in skin panels subjected to acoustic loading, 13 refs. 013090

Vlasov, F. V.; Ginevskii, A. S.
GENERATSIYA I PODAVLENIE TURBULENTNOSTI V OSESIMMETRICHNOI TURBULENTNOI STRUE PRI AKUSTICHESKOM VOZDEISTVII. (GENERATION AND SUPPRESSION OF TURBULENCE IN AN AXISYMMETRICAL TURBULENT JET BY ACOUSTIC ACTION).
Izv Akad Nauk (SSSR) Mekh Zhidk Gaza, n 6 Nov.-Dec. 1973, p 37-43

Results are presented of an experimental investigation into the effect of sound of different intensity and frequency on the parameters of averaged and pulsating flow in a submerged turbulent jet. It is shown that in case of both longitudinal and transverse exposure of the jet, depending on the frequency of the sonic signal, either intensification or weakening of the turbulent mixing takes place. Graphs are presented illustrating changes, under the action of acoustic disturbances, in the average velocity, in the pulsations of the longitudinal and trasverse velocity components at the jet axis, in the spectra of the longitudinal and transverse velocity pulsations, and in time-dependent Euler's correlations. Data on the optimal intensity of sonic exposure of a jet, necessary for the suppression of turbulence, are obtained. 16 refs. In Russian.

Propeller Noise

Healy, G. J.
INVESTIGATION OF PROPELLER VORTEX NOISE INCLUDING THE EFFECTS OF BOUNDARY LAYER CONTROL
Acoust Soc of Amer, NY, J, v 52 n 1, July 1972, p 112-188

An experimental investigation was conducted on the vortex noise produced by a two-bladed, 4 ft diameter model propeller capable of boundary layer removal. The propeller had a spinner comprising 70 percent of the total propeller radius. A porous section on both surfaces of the symmetric section airfoil allowed removal of the boundary layer. Free-field measurements were made in an anechoic chamber at three field points for three tip speed (209.5, 314.2 and 366.5 ft/sec) abd four blade angles (0°, 2.5°, 5°, and 10°) both without and with boundary layer control. Agreement with theory was good (within 2dB) showing a sixth power of tip velocity relationship and a classical dipole radiation pattern for the overall sound pressure level of the vortex noise. Boundary layer removal primarily affected sound levels above 3,150 Hz, with no ordered effect on the overall level

Longhouse, R. E.
APPLICATION OF EXTERNAL AERODYNAMIC DIFFUSION TO REDUCE SHROUDED PROPELLER NOISE
Acoust Soc of Amer, NY, J, v 52 n 1, July 1972, p 112-188

A major portion of the noise from V/Stol aircraft fan or shrouded propeller systems occurs during the hover mode. External diffusion of the exhaust flow during this mode significatly increases the thrust/power ratio. Attendant with the flow diffusion is a reduction in fan blade aerodynamic loading. The latter effect suggests a potential source of reducing the fan discrete-frequency noise. Results of model shrouded propeller tests to study the noise reduction associated with external diffusion are presented.

Longhouse, R. E.
APPLICATION OF EXTERNAL AERODYNAMIC DIFFUSION TO REDUCE SHROUDED PROPELLER NOISE
Acout Soc of Amer, NY, J, v 53 n 1, Jan. 1973, p 291-392

A major portion of the noise from V/ Stol aircraft fan or shrouded propeller systems occurs during the hover mode. External diffusion of the exhaust flow during this mode significatly increases the thrust/power ratio, Attendant with the flow diffusion is a reduction in fan blade aerodynamic loading. The latter effect suggests a potential source of reducing the fan discrete-frequency noise. Results of model shrouded propeller tests to study the noise reduction associated with external diffusion are presented.

Metzger, F. B.; Magliozzo, B.
NOISE CHARACTERISTICS OF QUIET PROPELLERS FOR STOL AIRCRAFT
Noise and Vibr Control Engr Conf, Proc, 1972, p xv-xxv

Noise is a critical parameter in the development of STOL transport aircraft for city center operation. As a result of interest in minimizing noise, an extensive program was conducted to establish the noise signature of low tip speed propellers suitable for STOL aircraft. Measurements were made for various propeller configurations under static, taxi, and flyover conditions. Using this information, the effect of aircraft speed on perceived noise level of aircraft in flight is projected. Also, the signature of this new quiet propeller is compared with that of existing STOL turboprop aircraft.

Helicopter Rotor Noise

Arndt, R.E.A.; Borgman, D. C,
NOISE RADIATION FROM HELICOPTER ROTORS OPERATING AT HIGH TIP MACH NUMBER
J Amer Helicopter Soc, v 16 n 1, Jan 1971, p 36-45

In the current effort, classical acoustic theory is used to predict the effects of compressibility and thickness on the overall noise level from helicopter rotors. it is found that some of the higher harmonics of helicopter rotor noise output are due mainly to drag divergence effects when the rotor is operating at high advancing- tip Mach numbers. a more realistic prediction of the helicopter noise spectrum may be obtained through a combination of the results of the present work with the previous results of M. V. Lowson and J. B. Ollerhead. Spectra are predicted for both the uniform-thickness rotor blade and a tapered-thickness blade. The tapered- thickness blade shows a substantial reduction in generated noise over the uniform- thickness blade when both blades are assumed to be at the same operating conditions. Better correlation is obtained between theory and experiment when compressibility and thickness effects are added to the rotational noise effects, particularly at the higher harmonics. 17 refs.

Arndt, R. E. A.; Nagel, R. T.
ROTOR NOISE ATTENUATION WITH LEADING EDGE DEVICES
Acout Soc of Amer, NY, J, v 52 n 1, July 1972, p 112-188

The noise attenuation effects of leading edge serrations on rotors were studied. Total radiated power, farfield sound pressure level, directivity patterns, nearfield sound characteristics, and rotor slip stream and wake characteristics were compared with rotors with and without leading edge devices. A substantial noise reduction was achieved with specific leading edge configurations and running conditions. A strong dependence on rotor speed and blade pitch angle was found. Spectral analysis of the total radiated power indicates that the attenuation occurs in both the pure tones and the broad-band component of the signal. The broad-band attenuation is shifted to continuously higher frequencies as the rotor speed increases. Nearfield data were collected in a manner indicative of rotational noise components. A considerable noise reduction in the higher harmonics of rotational noise was detected. Thrust and torque data indicated that the addition of leading edge serrations results in a decrease in L/D. Hot wire data show a strong decrease in the near-wake turbulence intensities. It appears that the rotor noise reduction phenomena encompasses both the rotational and vortex components of the noise signal. Reduction in the rotational components is traced to variations in the blade loading. Noise attenuation without performance penalty is therefore realized on the broad-band component only.

Cheney, M. C.; Dumond R. C.; Simon, D. R.; Robinson, R.; Williams, R.; Rogers, E. O.; Hirsh , N. B.; Ferris H. W.; Burkam, J. E.; Miao, W.; White, J. A.; Cronkhite, J. D.; Shipman,D. P.; Kuczynski, W. A.; Sharpe, D. L.; Sissingh, G. J.
28th ANNUAL NATIONAL V/STOL FORUM PROCEEDINGS.
Amer Helicopter Soc, Inc, 28th Annu Natl V/Stol Forum
Proc, Wash, DC, May 1972 Amer Helicopter Soc, NY, 1972
Prep of paper, 2 Parts, Various p

Thirty-seven papers were presented at the conference on helicopter design, performance characteristics and aerodynamics. Subjects included bearingless rotrs, dynamic stall investigations, handling sling loads, radar research, maneuverability and stability, flight testing and noise abatement. Following is part 1 of the list of titles and authors. Results of preliminary studies of a Bearingless Helicopter Rotor Concept, by M. C. Cheney; Flight Investigation of Design Features of the S-67 Winged Helicopter, by R. C. Dumond and D. R. Simon; New Hubs for Multi-Bladed tail rotors, By F. Robinson; Design Considerations of Circulation Control Rotors, by R. M. Williams and E. O. Rogers; Design Requirements for a Quiet Helicopter, by N. B. Hirsh and H. W. Ferris; Exploration of Aeroelastic Stability Boundaries With a Soft In-Plane Hingeless Rotormodel, by J. E. Burkam and W. Miao; Fuselage Nodalization, by J. Al White, by J. D. Cronkhite and D. P. Shipman; Hingeless Rotor Experimental Frequency Response and Dynamic Characteristics with Hub Moment Feedback Controls, by W. A. Kuczynski, D. L. Sharpe and G. J. Sissingh.

Hawkings, D. L.; Lowson, M. V.
THEORETICAL INVESTIGATIONS OF SUPERSONIC ROTOR NOISE.
Loughborough Univ Technol, Dep Transp Technol N TT-7213, Dec 1972, p 98

The Lighthill theory of aerodynamically generated noise and the Whitham weak shock theory are applied to two test cases. Results show how comparatively minor geometric changes to the duct can result in substantial acoustic benefit. One case studied gave up to 16dB additional attenuation over the straight duct. Thus it appears that the methods presented in this report could be used immediately for design optimization of ducted inlets for transonic fans. 20 refs.

Jones, J. P.
ROTOR AND ITS FUTURE.
Aeron J, v 77 n 751, July 1973, p 327-337

Various modifications in rotor design configuration and materials used are evaluated to overcome problems of drag, stability, control and excessive noise. Increasing tip speed could reduce noise and the effects of compressability. 5 refs.

Lyon, R. H.; Mark, W. D.; Pyle, R. W., Jr.;
SYNTHESIS OF HELICOPTER ROTOR TIPS FOR LESS NOISE.
J Acoust Soc Amer, v 53 n 2, Feb. 1973, p 607-618

Theoretical and computational studies were made of helicopter rotor-tip sound radiation for design for minimum noise in specified frequency bands. Allowing for radiation due to lift and thickness effests, numerical results are given for tip shapes for minimum high-frequency radiation. A relation is shown between tip section chord length and the minimum possible cutoff frequency for suppression of high-frequency sound.

Rinehart, S. A.
EEFECTS OF MODIFYING A ROTOR TIP VORTEX BY INJECTION ON DOWNWASH VELOCITIES, NOISE, AND AIRLOADS
J Amer Helicopter Soç v 16 n 4, Oct. 1971, p 48-54

Investigation shows that it should be possible to significantly alter the characteristics of the trailing tip vortex for almost all flight conditions in a beneficial manner by injecting an airstream directly in the forming tip vortex. Analytical expressions were developed for the initial and final states of the vortex in order to evaluate the effects of mass flow injection on the vortex strength, swirl velocity distribution, vortex core pressure, and vortex core size.

Walker, G. J.; Oliver, A. R.
EFFECT OF INTERACTION BETWEEN WAKES FROM BLADE ROWS IN AN AXIAL FLOW COMPRESSOR ON THE NOISE GENERATED BY BLADE INTERACTION
ASME Paper 72-GT- 15 for meeting, March 26-30 1972

Two sets of wakes can be made to mutually cancel the greater part of the velocity defect in each at certain points. Proper choice of axial and circumferential position of alternate rows of stationary blades so that the downstream row is in the middle of the wake street from the upstream row allows the velocity defect normally in the rotor wakes to be thus cancelled at the position of the stator and considerably reduces the noise produced at the rotor blade passing frequency by the rotor wakes on the stator. The effect of stator wakes on rotor blades downstream of the first can be similarly reduced by lining up blades in successive rotor rows. The deductions are confirmed by measurements of sound pressure level. 13 refs.

Widnall, S.
HELICOPTER NOISE DUE TO BLADE-VORTEX INTERACTION
J Acoust Soc Amer, v 50 n 1 pt 2, July 1971, p 354-365

A theoretical model is given for the radiated sound due to helicopter "blade slap" an impulsive sound due to blade-vortex interaction for helicopter rotors. The unsteady lift on blades is calculated using linear, unsteady aerodynamic theory for the oblique gust model of the blade-vortex interaction. Expressions are derived for directivity, frequency spectrum, transient signal, and total power of acoustic signal. 13 refs.

Windall, S.
WIND-TUNNEL STUDIES OF HELICOPTER ROTATIONAL NOISE IN FORWARD FLIGHT
Acoust Soc of Amer, NY, J, v 53 n 1, Jan. 1973, p 291-392

Wind-tunnel studies of helicopter noise carried out on a model rotor operating in a large open-jet wind tunnel are described. The tunnel test section is surrounded by an anechoic chamber. Data processing techniques were used to obtain the average-repeated-transient signal/revolution and thus to extract the rotational noise from the total noise, which includes random components. Blade-vortex interaction is clearly visible in many of the repeated-transient signals and is felt to be an important contributor to rotational noise even outside of the blade-slap condition. Vortex noise can be identified in the spectra of the total signal. In addition to the vortex noise, a broadband noise of lower frequency is evident. This lower-frequency noise is due either to vortex-wave unsteadiness or to local stall on the blades at certain azimuth locations.

Wright, S. E.
DISCRETE ROTOR NOISE
Noise and Vibr Control Engr Conf, Proc, 1972, p XV-XXV

A single unified theory is described to account for the discrete radiation from the whole family of heavily run axial flow rotors including helicopter rotors, propellers and compressors. Founder analysis is used to evaluate the periodic blade loading variation (Azimuth profile) into blade loading harmonics, and then sum the total radiation from each BLH. In this way, the radiation from any arbitrary blade loading variation and the rotor noise can be determined. The basic differences between high and low solidity rotor spectrums are considered, emphasizing the difference between subsonic and supersonic rotor noise. The special effect of helicopter blade slap and compressor rotor-stator interaction is discussed, and measured rotor spectrums are included to help illustrate the theory.

Aerodynamic Noise

Theory-

Fuchs, H. V.; Michalke, A.
FOUR INTRODUCTORY LECTURES ON AERODYNAMIC NOISE THEORY.
Dtsch Luft Raumfahrt, Mitt 71-20, Oct. 1971, p 114

The report presents an introduction to the theory of aerodynamic sound generation. In lecture 1 a general integral solution to the inhomogeneous wave equation is discussed. In lecture 2 certain approximations are given for the far-field sound intensity. Jet noise is treated particularly in lecture 3 on the assumption of a specific structure of the turbulence convected by the flow. Lecture 4 treats special methods in jet noise theory. Individual frequency components of the sound intensity are derived by means of a Fourier transform with respect to time. 14 refs.

Configuration -

Goldman, R. L.; Obremski, H. J.
EXPERIMENTAL INVESTIGATION OF HYPERSONIC BUZZ ON A DELTA CONFIGURATION.
AIAA J, v 11 n 10, Oct. 1973, p 1361-1362

Description of an experimental study which confirms the existence of hypersonic buzz in the separated region of a downward deflected control surface. Wind-tunnel tests in helium at $M = 17.5$ clearly demonstrated the occurrence of large-scale pressure oscillations throughout a substantial range of angles of attack and control surface deflection on a blunt slab, delta configuration. Measurements of surface pressure fluctuations and observations of high-speed Schlieren photographs served to delineate the boundaries of the phenomenon and to identify the physical parameters necessary for the onset of a buzz condition. 3 refs.

Jones, R. T.
NEW DESIGN GOALS AND A NEW SHAPE FOR THE SST.
Astronaut Aeronaut, v 10 n 12, Dec. 1972, p 66-70

A wing which pivots as a whole would permit supersonic aircraft that both avoid sonic boom and reduce noise around airports. Turning the wing to different oblique angles for flight at different Mach numbers, in conjunction with an optimum wing shape, provides minimum induced drag. Results with models in wind tunnel tests, coordinating wing shape and angle with lift/drag ratios, are shown. 10 refs.

Boundary Layer -

Bhat, W. V.
FLIGHT TEST MEASUREMENT OF EXTERIOR TURBULENT BOUNDARY LAYER PRESSURE FLUCTURATIONS ON BOEING MODEL 737 AIRPLANE
J Sound Vibr, v 14 n 4, Feb. 22, 1971, p 439-457

The flight test measurements indicate that the turbulent boundary layer is a major source of exterior pressure fluctuations at the forward location on the Boeing model 737 airplane. The RMS levels, shapes of the spectrum, convection velocity and space-time correlation are investigated. The angle of attack, I. E., angle between a fuselage axis or axis of the structure and the flow direction, has a significant effect on the decay rate and it should be properly accounted for in any analytical model that is used for estimating structural response. 19 refs.

Bhat, W. V.; Wilby, J. F.
INTERIOR NOISE IRRADIATED BY AN AIRPLANE FUSELAGE SUBJECTED TO TURBULENT BOUNDARY LAYER EXCITATION AND EVALUATION OF NOISE REDUCTION TREATMENTS
J Sound Vibr, v 18 n 4, Oct. 22 1971, p 449-464

The acoustic power radiated by an airplane fuselage structure exposed to a turbulent boundary layer pressure field has been measured at two flight Mach numbers. For a single fuselage panel the radiated power is approximately 90 and 70 dB relative to 10-//3 W at Mach 0. 85 and 0. 55 respectively. Damping tape and rubber wedge treatments, applied to the structure, reduce the acoustic radiation but they are more effective at Mach 0. 85 than at Mach 0. 55,. The flight test data are in poor agreement with available wind tunnel measurements, indicating the need for improvements in scaling laws. 11 refs.

Bergstrom, E. R.; Raghunathan, S.
AERODYNAMIC NOISE AND BOUNDARY-LAYER TRANSITION MEASUREMENTS IN SUPERSONIC TEST FACILITIES.
AIAA J, v 10 n 11, Nov. 1972, p 1531-1532

Study of the boundary-layer transition and aerodynamic noise on models tested in supersonic flow. It is pointed out that existing evidence seems to indicate that the transition is closely related to the pressure fluctuations radiated into the working section by the turbulent boundary layer on the nozzle walls. A comparison is made of noise measurements conducted in supersonic flow by various authors and, based on this comparison, it is shown that a relationship between sound pressure level and transition Reynolds number actually holds for a considerable volume of earlier transition data obtained in a wide variety of wind tunnels. 3 refs.

Wake Vortices-

Burnham, D.; Kodis, R.; Sullivan, T.
OBSERVATIONS OF ACOUSTIC RAY DEFLECTION BY AIRCRAFT WAKE VORTICES.
J Acoust Soc Amer, v 52 n 1, Part 2 July 1972, p 431-433

Communication to the editor reports observation of acoustic ray deflection by aircraft wake vortex flows during landing of large aircraft, as previously predicted by Georges. The phenomenon was used to detect and locate vortex traces in a plane perpendicular to the runway center line.

Miscellaneous-

Candel, S. M.
DIFFRACTION OF A PLANE WAVE BY A HALF PLANE IN A SUBSONIC AND SUPERSONIC MEDIUM.
Acoust Soc of Amer, J, v 54 n 4, Oct. 1973, p 1008-1016

A technique is presented for transforming certain acoustical boundary value problems in a subsonic moving medium to a problem involving a stationary medium. The method is described by discussing the Sommerfield problem of diffraction of a plane wave by a half plane immersed in a subsonically moving medium. Additional sources are induced by the flow at a leading edge impinged by a plane wave, while a trailing edge only gives rise to the usual diffracted wave. The flow also convects the geometrical acoustics part of the field. A transformation applied to the supersonic diffraction problems yields a unique reference problem, which is sloved by Fourier transform methods. The pressure field is decomposed in a sum of a geometric acoustics field and a supersonic diffracted wave showing some remarkable similarities with the subsonic solution.

Clark, L. T.
RADIATION OF SOUND FROM AN AIRFOIL IMMERSED IN A LAMINAR FLOW
ASME Paper 71-GT-4 for meeting, March 28-April 1 1971

The results of an experimental and analytical investigation of sound generation by single airfoils are presented. Airfoil sections studied were representative of those used in modern axial compressors. Included were modified 65 series and double circular arc profiles. The radiation of sound from the airfoil immersed in the potential core of a free jet discharging through an acoustic chamber was measured. Acoustic data were obtained for the velocity range 200 through 800 fps Measurements of wake correlation volumes and turbulence velocity components were used in an analytical model to predict the spectrum of the sound radiated by the airfoil. Sound generation was found to be dependent upon the square of the component of turbulent velocity normal to the airfoil chord. In the velocity range 300 to 800 fps, the overall sound pressure level was found to be dependent upon free stream velocity to the sixth power. A correlation of the normal component of turbulent velocity was found to exist with the momentu[illegible]kness of the wake. 7 refs.

Goldstein, M.; Rosenbaum, B
EFFECT OF ANISOTROPIC TURBULENCE ON AERODYNAMIC NOISE
Acoust Soc of Amer, J, v 54 n 3, Sept. 1973, p 630-645

A model based on Lighthill's theory for predicting aerodynamic noise from a turbulent shear flow is developed. The model is a generalization of the model developed by Ribner. It does not require that the turbulent correlations factor into space and time-dependent parts. It replaces his assumption of isotropic turbulence by the more realistic one of axisymmetric turbulence. A hierarchy of equations was developed wherein each succeeding equation involves more assumptions than the preceding equation but requires less experimental information for its use. The implications of the model for jet noise are discussed. For the particular turbulence data considered anisotropy causes the HF self-noise to be beamed downstream.

Hay, J. A.
SHOCK-CELL NOISE, AIRCRAFT MEASUREMENTS
J Sound Vibr, v 17 n 4, Aug. 22 1971, p 509-516

A description is given of flight test measurements designed to determine the cause of severe acoustic loading on the tail planes of early V. C. 10 and B. A. C. 1-11 aircraft. This loading was found to be due to in-flight shock-cell noise. A convergent-divergent nozzle design, together with minor structural modifications, was found to give the greatest overall alleviation of the problem for these two particular aircraft. 10 refs.

Hodgson, T. H.
ON THE DIPOLE RADIATION FROM A RIGID AND PLANE SURFACE
Noise and Vibr Control Engr Conf, Proc 1972, p XV-XXV

Aspects of wall pressure fluctuations in a turbulent boundary layer flow at low Mach number over a rigid and plane infinite surface have been experimentally examined. Correlations of the fluctuating wall pressure were taken on the lower surface of the wing of a high performance sailplane in flight. Results indicate that in the limiting case of zero Mach number the instantaneous force on a plane surface from this fluctuating pressure field is zero to within experimental accuracy. It is also likely that at low Mach numbers any dipole radiation from the pressure fluctuations is quite negligible. The power spectrum of the wall pressure fluctuations is dominated by incompressible effects and is perfectly flat down to very small Strouhal numbers.

Mangiarotty, R. A.
AERODYNAMIC FLOW NOISE INTERFERENCE IN ACOUSTICALLY LINED DUCTS
Acoust Soc of Amer, J, v 50 n 6, Dec. 1971, p 1447-1448

In the course of studying the basic properties of acoustic linings for ducts transmitting air at high speeds, experimental evidence indicated that aerodynamic noise generated by the flowing air could limit the magnitude of noise attenuation inside the duct achievable by means of linings. A discussion of the matter leads to the conclusion that aerodynamic noise generated by the fluid flow could limit the maximum attenuation achievable.

Westley, R.; Lindberg, G. M.; Chan, Y. Y.; Lee, B. H. K.
AERODYNAMIC AND STRUCTURAL NOISE RESEARCH AT NAE.
Natl Res Counc Can, Div Mech Engr, Natl Astronaut Extabl,Q Bull Rep NDME/NAE 1972 n 1, p 1-21

Unsteady aerodynamic flow processes radiate sounds that are known as aerodynamic noise. Aerodynamic noise becomes most intense when it is generated by high subsonic or supersonic flows. Thus the paper discusses the problems to expect, intense sources of noise to be found in high speed jets, compressible flow boundary layers and high speed rotors. 43 refs.

Equipment Noise

Ganesan, N.
COMPOSITES FOR NOISE CONTROL.
SAE Prepr, n 730339 for meet, April 3-6, 1973

A survey of the use of composite structures for noise control, particularly in an aircraft cabin, is presented in this paper. The various sources of the noise entering the cabin and the measures to deal with them are considered. Guidelines for optimum distribution of masses in the skin, septumand trim panel, and for choosing thickness of insulation materials and air space are presented.

Hartman, R. M.
DYNAMICS APPROACH TO HELICOPTER TRANSMISSION NOISE REDUCTION AND IMPROVED RELIABILITY.
Amer Helicopter Soc, 29th Annu Natl V/Stol Forum, Proc, Prepre, Wash., DC, May 1973, paper 772, p 12, Available from Amer Helicopter Soc, Inc, NY, 1973

Decription of some of the results of a program to reduce transmission noise on the heavy-lift helicopter. Covered is the mathematical modeling of transmission components and the determination of their damped force response. The correlation of these responses with experimental data and,

finally, the use of the mathematical model in the design of the heavy-lift helicopter transmission. 10 refs.

Jhaveri, A. G.
ENGINEERING DESIGN CONSIDERATIONS IN THE NOISE CONTROL OF COMMERCIAL JET AIRCRAFT'S VENT AND DRAIN SYSTEMS
Inter-Noise 72. Intl Conf on Noise Control Engr. Proc, 1972, p 2-4

Engineering design considerations for controlling unacceptable and unsatisfactory noise levels in jet airplane cabin lavatories and toilet rooms are described. The main source of objectionable noise comes from the operation of exhaust air-vent and water drain systems, including toilet flush mechanisms. An acoustical muffler was designed to control exhaust and intake noise levels. If the muffler was not in the cartridge, noise levels remained unacceptable. When the muffler was included as part of the systems design, acoustical requirements were satisfied. Three types of acoustical wall panels were acceptable when used with the cartridge-muffler combination, and 1-in. (inside diameter) neoprene tubing throughout the system met design specifications and satisfied aerodynamic requirements. Either ay or T connector with a minimum of 1-in. spacing from the cartridge-muffler system effectively reduced lavatory vent/drain systems noise.

Wellauer, E. J.; Schunck, R. A.
GEAR UNIT SOUND GENERATION, TRANSMISSION, CONTROL, AND SPECIFICATION.
TAPPI, v 56 n 6, June 1973, p 69-72

Gear unit sound is generated by the rotating gear unit elements. 3 refs.

Sonic Boom

Theory-

Davis, S. S.
CALCULATION OF SONIC BOOM SIGNATURES BY BICHARACTERISTIC METHODS
AIAA, J, v 10 n 9, Sep. 1972, p 1211-1215

An improved method is descirbed for correcting the zeroth order (freestream) charcateristic to obtain a uniformly valid first order solution to the exact equations of motion for a compressible fluid. The method is based on constructing first order bicharacteristic lines from the system of ordinary differential equations belonging to the exact equation for the characteristic suface. Claculated sonic boom signatures are compared with experiments conducted at Langley Research

Center on a cone-cylinder at Mach numbers 2, 96, 3, 83, and 4,63. Theory and experiment agree well over the entire Mach number range. 13 refs.

Hayes, W. D.
SONIC BOOM
Annu Review of Fluid Mech, v 3. Annu Review, 1971, p 269-290

The theory and propagation of sonic boom is considered. A review of the literature in which the boom is treated is presented with emphasis on optimization and reduction of sonic boom effects, for design of a successful overland supersonic aircraft free from causing a bang boom. 48 refs.

Kamali, G.; Pierce, A. D.
TIME DEPENDENCE OF VARIANCES OF SONIC BOOM WAVEFORM
Nature, v 234 n 5323, Nov. 5, 1971 p 30-31

In a series of experiments performed in 1966 at Edwards Air Force Base, California, sonic boom pressure signatures were recorded at 42 ground level microphones, equally spaced in an 8,000 foot linear array, during level over flights of F-104 fighter aircraft at flight Mach numbers of approximately 1.3 and at an altitude of approximately 30,000 feet. The array was almost directly beneath the flight track. The variations in the signatures recorded by different microphones during the same over flight are believed to be caused primarily by atmospheric turbulence. An analysis of the variations in these data is reported.

Lee, B. H. K.; Ribner, H. S.
DETERMINISTIC MODEL OF SONIC BOOM PROPAGATION THROUGH A TURBULENT ATMOSPHERE.
Natl Res Counc Can, Aeronaut Rep LR-566, Nov. 1972,

The propagation of a weak normal shock wave through a turbulent atmosphere is studied in terms of an idealized model. The turbulent field is assumed to be weak and represented by the superposition of two incline JD shear waves of opposite inclination to the mean flow. The resulting flow is of a cellular nature. The cells are rectangular in shape and the sense of rotation of the flow alternates from cell to cell. If the angles made by the normal of the incident shear waves with the direction of the mean flow are greater than some critical value an exponentially decaying pressure wave is generated behind the shock. "Spiked" or "rounded" waveforms are obtained by adding or subtracting this pressure wave from the steady state pressure field.

Miller, D. S.; Carlson, H. W.
APPLICATION OF HEAT AND FORCE FIELDS TO SONIC- BOOM MINIMIZATION
J Aircraft, v 8 n 8, Aufust 1971, p 657-662

There is much interest and some controversy concerning the possibility of sonic-boom suppression through airstream alteration by application of force and heat fields. This paper presents a discussion of the relationship of these more exotic schemes to conventional approaches involving shaping of the airfract itself, describes the required flowfield alteration for the more promising heat field method and provides a first estimate of power requirements. 26 refs.

Pierce, A. D.
MAXIMUM OVERPRESSURES OF SONIC BOOMS NEAR THE CUSPS OF CAUSTICS
Noise and Vibr Control Engr Conf. Proc, 1972, p XV-XXV

The generation of cusped caustics (regions of focalization) by maneuvering or accelerating supersonic aircraft is discussed. A simplified theory is presented for estimation of the peak overpressure at a caustic cusp (arete or a line of super-focalization), where anomalously large focus factors of the order of 10 have recently been detected in the French Field tests operation Jericho. The maximum parameters in the analysis are the minimum radius of curvature of the shock from some time before it reaches the cusp: the second derivative of the curvature radius with respect to transverse distance along the front: and the peak overpressure at the point where these curvature radii are measured. The results are applied to cases of superbooms during maneuvers and it is concluded that the focus factor at the cusp varies with nominally expected overpressure.

Thomas, C. L.
SONIC BOOM REFLECTION FACTORS FOR FLIGHT NEAR THE THRESHOLD MACH NUMBER
J Aircraft, v 8 n 6, June 1971, p 490

The purpose of this note is to consider the reflection of a very weak shock wave off a smooth surface, for the condition in which the incident shock wave is nearly perpendicular to the surface. In this situation the pressure rise across the reflected shock can be up to twice the pressure rise across the incident shock, indicating that sonic boom reflection factors as large as three are possible for aircraft traveling near the threshold Mach number.

Wanner, J. C. L.; Vallee; Jacques; Vivier; Taude; Thery; Claude
THEORETICAL AND EXPERIMENTAL STUDIES OF THE FOCUS OF SONIC BOOMS
Acoust Soc of Amer. NY, J, v 52 n 1, July 1972, p 13-32

Knowledge of sonic booms produced by airplanes in steady rectilinear flight is now suffiecient to allow for good predictions of the phenomena. In order to improve the knowledge of the effects of accelerations and curvatures of the flight path, the French working group on sonic booms undertook a set of theoretical and experimental studies on that subject. Theoretical studies of the propagation of the shock waves helped identify the different cases of focus (linear acceleration, turn, pushover) and superfocus (entry to turn). After measurement of the actual characteristics of the atmosphere, it was possible to guide an airplane in order to produce focusing in a measurement zone of realistic size. During the four experimental exercises of operation Jericho the accuracy of prediction of propagation and guidance of the airplane showed that focus factors are higher than those predicted.

Warren, C. H. E.
A SIGNIFICANT SINGLE QUANTITY THAT TYPIFIES A SONIC BANG
Acoust Soc of Amer. J, v 51 n 1, Jan. 1972, p 418-420

Characteristic overpressure is defined as 4I/T. Where I is the maximum impulse that is, the maximum value of the running integral of the overpressure with respect to time, and T is the signature interval (the time interval betwwen the onset of the first shock and the onset of the last shock in the signature). Characteristic overpressure is considered to be a significant quantity, particularly in regard to the effect of sonic bangs on the structures, and is shown to lead to a particularly simple engineering formula for the dynamic magnification factor as a function of the product of the natural frequency of a structure and the signature interval.

Interaction with Water-

Intrieri, P. F.; Malcolm, G. N.;
BALLISTIC RANGE INVESTIGATION OF SONIC-BOOM OVERPRESSURES IN WATER.
AIAA J, v 11 n 4 April 1973, p 510-516

An investigation of sonic-boom overpressures in water conducted by launching small models over water-filled tanks in a ballistic range yielded shadowgraph pictures and underwater pressure measurements that lead to the following conclusions. Flights over water that produce an incident shock wave which travels along the surface of the water at speeds greater than the speed of sound in water - i.e. , greater than 4.4 - produce shock waves in water; the variation in peak pressure associated with the shock wave with distance from the flight path is not affected by water depth but behaves exactly as it does in air. If the speed of the incident wave, however, is less than M= 4.4, only sound waves are produced under water and the peak pressure decays rapidly with depth and is well predicted by theory. 9 refs.

Waters, J. F.
PENETRATION OF SONIC BOOM ENERGY INTO THE OCEAN: AN EXPERIMENTAL SIMULATION
Noise and Vibr Control Engr Conf, Proc, 1972 p XV-XXV

An acoustically scaled sonic boom simulation experiment was performed, and the results verify the validity of current theoretical predictions of the penetration of sonic boom energy into a flat ocean. The effect of the penertration into the ocean should not be significant at depths greater than about 100 feet, on the basis of comparisons with ambient sound pressure levels.

Flight Profiles-

Hilton, W. F.
LOCAL AVOIDANCE OF SONIC BOOM FROM AN AIRCRAFT
Aeron J, v 75 n 723 March 1971, p 179-181

A flight path is proposed for an aircraft flying at 60,000 feet and Mach 2, permitting it to fly over a city 10 miles in diameter without generating a sonic boom in that city. It involves the passengers in a maneuver of less than plus or minus 1/2 g. Only one case has been analyzed. and it is not claimed that this is optimum but merely that the technique is both possible and of interest.

Ribner, H. S.
SUPERSONIC TURNS WITHOUT SUPERBOOMS.
Toronto Univ, Inst Aerosp Stud, Utias Tech Note, n 174, Feb. 1972

It is shown that focussed boom that arise in turning flight can be suppressed by the simple (although not always practicable) expedient of slowing down the aircraft. The correct deceleration will eliminate the local curvature of the wave front responsible for the focussing. Specifically, the tangential decleration resolved along the normal to the wave front is adjusted to cancel out the centripetal acceleration similarly resolved. Horizontal turns of a prescribed limiting sharpness are not of concern for this suppression technique: their focussed booms will be cut off from reaching the ground by atmospheric refraction. The minimum turn radius for focus cut-off is related herein in a simple fashion to the tabulated width of the sonic boom carpet for rectilinear flight, as a function of Mach number and altitude. 4 refs.

Simulation-

Gottlier, J. J.; Glass, I. I. ;
RECENT DEVELOPMENTS IN SONIC-BOOM SIMULATION USING SHCOK TUBES.
Can J Phys v 52 n 3, Feb. 1, 1974, p 207-218

Gasdynamic and acoustic analyses are performed in order to provide greater insight into the operation of sonic-boom simulators utilizing shock-tube

drivers. Three basic shock tubes are considered; each has a pyramidal driver joined at the diaphragm station to a pyramidal channel of the same divergence angle (pyramidal shock tube). or of a different angle, or joined to a constant-area channel. Classical acoustic theory is applied to obtain new analytical solutions to describe the wave motion in such facilities, in agreement with experimental data. 18 refs.

Ribner, H. S.; Morris, P. J.; Chu, W. H.
LABORATORY SIMULATION OF DEVELOPMENT OF SUPERBOOMS BY ATMOSPHERIC TURBULENCE.
J Acoust Soc Amer, v 53 n 3, March 1973, p 926-928

A jet flow was used to roughly model a localized region of atmospheric turbulence, demonstrating the velocity-gradient effect. Spiked and rounded boom signatures were produced, similar to those produced in supersonic flight under turbulent atmospheric conditions. 12 refs.

Measurement-

Delany, M. E.; Johnson, D. R.; Pernet, D. F.; Rennie, A. J.
MEASUREMENTS OF SONIC BANGS DURING EXERCISE "SUMMER SKY"
Teddington, Engr Natl Phyl Laboratory, Acoust Rep AC55 March 1972

Pressure waveforms measured during sonic boom tests over London in 1967 are presented. The direction of arrival of each shock, determined with a microphone array, is compatible with directional data deduced theoretically from ray-path calculations for an atmosphere having both temperature and wind gradients. Calculated values of relative time of arrival of shock waves reflected from the face of local buildings are shown to correspond well with shocks clearly identifiable on the oscillograms.

Goforth, T. T.; McDonald, J. A.
PHYSICAL INTERPRETATION OF SEISMIC WAVES INDUCED BY SONIC BOOMS
J Geophys Res, v 75 n 26, Sept. 10, 1970, p 5087-5092

A physical interpretation is presented for the seismic waves induced by the passage of a sonic boom over the surface of the earth: particle velocity measurements show that the seismograms consist essentially of two different phenomena: the larger particle velocities are associated directly with the sonic boom wave, and the smaller velocities are produced by air-coupled Rayleigh waves. The amplitudes and shapes of the waves associated with the waves are theoretically predicted. 14 refs.

Pan, Y. S.; Wang, K. T.
METHOD FOR WIND-TUNNEL INVESTIGATION OF SONIC BOOMS.
AIAA J, v 10 n 11, Nov. 1972, p 1408-1414

A method for extrapolation of three-dimensional wind-tunnel data obtained in the very near field of an aircraft configuration is proposed. Several numerical examples for axisymmetric and nonaxisymmetric flowfields are given. Comparisons of the present results with those based on the current sonic boom theory show that the three-dimensional near-field effects are important. 16 refs.

Smigielski, P.; Hirth, A.; Thery,C.
APPLICATION OF HOLOGRAPHY TO SONIC BOOM INVESTIGATIONS.
IEEE Trans Aerosp Electron Syste, v AES-8 n 6, Nov. 1972, p 751-756

A Q-switch single-mode ruby laser is used for holographic recording of simulated sonic booms. The gasous objects are visualized by means of differential interfrometry in polarized light. As well as the Schlieren method with defocused phase plate. Both techniques are applied to the holographically recorded wave (directional lighting). Interferometry by double exposure with directional lighting is also used to visualize the gaseous objects. 10 refs.

Miscellaneous-

Eggleton, P. L.
SONIC BOOM, WEIGHING ITS IMPLICATIONS FOR POLICY CONSIDERATIONS
Anglo-Amer Aeronaut Conf, 12th, July 7-9 1971, Can Aeronaut amd Space Inst. 1971, paper n 72/4

Identification of the various sonic boom implications for humans, animals, structures, terrain and the ecology is presented and a suggestions is made of which overflight policy alternative could be opted for in each case. Subsequently they are related to the economic, social, political and strategic benefits that a country should weigh to arrive at a decision regarding the sonic boom. The methodology described is believed to be sufficiently universal so that any country can identify its variables in the sonic boom policy equation. 14 refs.

Galanis, N.
THERMODYNAMIC CONSIDERATIONS FOR THE DESIGN OF A SONIC-BOOM REDUCING POWERPLANT.
ASME Paper, n 72-WA/AERO-3 for meet Nov. 26-30 1972

A two-dimensional biplane-like structure is used as an example to show that it is possible to design lifting boomless configurations by processing the captured airstream so that the streamtube area is smaller at the exit than at the entrance. The principle is then extended to three-dimensional cases, and thermodynamic guidelines are given for the design of propulsive units that will reduce sonic-boom intensity. 6 refs.

Gilbert, G. H.; Less R.
SOME METEOROLOGICAL PROBLEMS OF SUPERSONIC FLIGHT.
Can Aeronaut Space J, v 18 n 4, April 1972, p 85-89

The main features of the atmosphere that are pertinent to the operation of commercial supersonic aircraft are described, and the meteorological aspects of the sonic boom phenomenon are briefly reviewed. The meteorological requirements and implications of the climb, cruise and descent phases of SST that are peculiar to this type of aircraft are discussed in some detail, including the effect of the meteorological parameters on the intensity and areal extent of the sonic boom. The takeoff fuel requirements for commercial supersonic aircraft will be much more sensitive to possible errors in forecast temperatures than in the case of subsonic aircraft, but less sensitive to errors in forecast winds. 10 refs.

Lips, K. W.
AN UNSTABLE STEERING TASK WITH A SONIC BOOM DISTURBANCE
Toronto. Univ, Inst for Aerospace Studies. UTIAS Tech Note n 179
September 1972

An initial study was made concerning the effect of sonic-boom disturbances on an individual's compensatory tracking performance for an unstable system. In certain respects the tracking task simulated automobile driving. Sonic-boom disturbances of the type generated by the Concorde supersonic transport result in a measurable startle effect (performance deteriorated during the tracking task) manifesting itself in somewhat different ways for different individuals at different times. The performance loss pattern involved an initial startle followed by peak amplitude response, sometimes partial recovery, and total recovery. The results apply only to that particular task simulated during this study.

Lundberg, B.
THER SUPERSONIC TRANSPORT DILLEMMA
Noise 2000. Assoc Intl Contre Ie Bruit. Intl Congresses. p 16-22, 1971

An evaluation of noise pollution from supersonic transport (SST) booms is presented. The SST boom would be at least 10 times too strong for being acceptable over land. Several countries have already prohibited supersonic overflights. Building of production aircraft of Concorde and U.S. SST prototypes started on assumptions that the boom will not cause appreciable harm over sea, and that supersonic operation restricted to sea routes will be an economic success. Both assumptions are incorrect;

SST booms will cause severe disturbance, fright, and risks of accidents to people at sea. The burden of proof that these effects are acceptable rests with the SST investing governments and industries. They should therefore carrry out adequate boom tests over sea. If such tests are not made very soon, they run the future risk of having to scrap all the SSTS when the operation has become so extensive that the frequent oversea booms have definitely become intolerable. Then people at sea and governments of shipping and fishing nations will certainly find ways and means of stopping the activity. Restriction to supersonic speed over water will result in huge operation losses. As operation losses escalate, SST investors will be severely tempted to exert pressure for obtianing permissions to fly supersonically over land. To resist this there is an urgent need for sleep disturbance tests for confirmation that the SST boom is far too severe for being acceptable over land.

Oswatitsch, K.; Sun, Y. C.
WAVE FORMATION AND SONIC BOOM DUE TO A DELTA WING.
Aeron Q, v 23, pt 2, May 1972, p 87-108

By employment of the analytical method of characteristics and of a limiting procedure suitable for dealing with the trailing edge expansion, the influence of near-field flow on the far-field wave formation has been investigated for an incident flat delta wing with supersonic leading edges. The front shock due to a delta wing will as a rule be cancelled at a finite distance from the wing by the plane-wave expansion emanating from the trailing edge. The over-expansion must then give rise to a rear shock separate from the front one. Thus at least in the plane of symmetry, a sharp-front wave signature cannot, in general, be expected from the wing at a distance beyond the terminating point of the front shock. The boom signature then will be qualitatively different from that of a body of revolution. 17 refs.

Ribner, H. S. E.; Hubbard, H. H.
SONIC BOOM SYMPOSIUM
Sonic Boom Symp. Acoust Soc of Amer. 80th meeting

The generation, prediction, propagation and simulation of sonic booms are discussed, along with the effects of booms on terrain, water, structures, animals and humans.

Stevens, J. H.
THAT SONIC BANG
Envr This Month. The Intl J of Envr Science. Lancaster, Engr.
v 1 n 2 August 1972, p 34-39

Physical properties, causes, and effects of the sonic boom are discussed. Factors affecting the boom are analyzed, including aircraft shape and weight, meteorological conditions, and height at which the aircraft is flying. Maneuvering and acceleration can cause a four- or six-fold increase in boom intensity due to focussing. The worst booms come during initial acceleration to supersonic speed because all factors tend toward the largest pressure pulses. The airplane is relatively low and at maximum weight and high incidence.

Wilhelmsen, A. M.; Larsson, B.
SONIC BOOMS AND STRUCTURAL DAMAGE
Natl Swed Build Res. Doc D3. 1973

A series of field tests was performed for the assessment of damage to buildings. Two timber framed test buildings were erected, one using prefabricated sections and the other in-situ construction with one replaceable external wall. Fifty-threee overflights at supersonic speeds, at altitudes ranging from 100 to 13,000 m, were carried out over the test buildings. The overpressure created was recorded both in and out of doors and movements in different parts of the buildings were measured. 64 refs.

Willms, W.
FORSCHUNGSERGEBNISSE ZUM UEBERSCHALLKNAIL
Noise 2000. Assoc Intl Contre Le Bruit. Intl Congresses. p 16-22, 1971

Results of sonic boom research that have been reached in several countries are surveyed. The generation and propagation of shock waves including random magnifications and superbangs are considered and effects on humans and structures are examined, with the most important response criteria given.

Flyover Noise

Signatures-

Gonter, R. H.
INTENSITY FLUCTUATIONS OF AIRCRAFT FLYOVER NOISE
Acoust Soc of Amer, Menasha, Wis. J, v 52 n 5, Nov 1972, p 1309-1317

The sounds of aircraft flyovers were tape-recorded in stereo with microphones spaced up to 30 m. A peak detector was used on playback to obtain the sound intensity fluctuations which were then recorded on a strip chart. Fluctuations were punched on cards for digital computer processing resulting poor. Spectra were analyzed for propeller planes and jets and showed considerable variation.

Urick, R. J.
NOISE SIGNATURE OF AN AIRCRAFT IN LEVEL FLIGHT OVER A HYDROPHONE IN THE SEA.
J Acoust Soc Amer, v 52 n 3, part 2, Sep 1972, p 993-999

Observations are made on the underwater noise made by a prop jet flying over hydrophones at two different depths. Simple ray theory is shown to account for the signature under the conditions of the experiments. 12 refs.

Zweiback, E. L.
FLYOVER NOISE TESTING OF COMMERCIAL JET AIRPLANES
J of Aircraft, v 10 n 9, Sept 1973, p 538-545

The flight development and certification programs of new commercial jet transport airplanes include flyover noise testing to define public acceptability of the airplanes. Government noise standards for aircraft-type certification have influenced flight testing procedures for airplane flyover noise testing. Specific field and flight data systems include: a noise recording array dispersed over a surveyed ground test range; recording stations for the surface weather (continuous) and the sound path weather (periodic); a tracking facility for the precise continuous recording of the airplane space position; and aircraft instrumentation for recording time-synchronized airplane engine operating parameters. Data processing utilizes advanced techniques that integrate all data components of the test airplane noise system. Existing test techniques are generally adequate for the present.

Flight Path Control-

Clifford, D. R.
APPROACH PATH CONTROL FOR REDUCED NOISE AND IMPROVED TRAFFIC CAPACITY
Agard Conf Proc n 76 37th meeting of Flight Mechanics Panel, Oct 20-23 1970, Baden-Baden, West Germany, Mar 1971 paper 15

Denery, D. G.; Bourquin, D. R.; White, K. C.; Drinkwater, F. J.; III
FLIGHT EVALUATION OF THREE-DIMENSIONAL AREA NAVIGATION FOR JET TRANSPORT NOISE ABATEMENT
J of Aircraft, v 10 n 4, April 1973, p 226-231

The NASA Ames Research Center, working with American Airlines, completed the first phase of research to evaluate the operational feasibility of two-segment approaches for noise abatement. Area navigation was used to establish the upper glide slope, and an instrument landing system (ILS) was used to establish the lower. The flight was modified to provide command information during the entire approach. Twenty-eight pilots representing the airlines, professional pilot associations, FAA, and NASA participated. With an ILS approach for comparison, the precedure gave a noise reduction of 18 EPNdB (effective perceived noise in decibles) at the outer marker and 8 EPNdB 1.1 nm from touchdown.

Halwes, D. R.
FLIGHT OPERATIONS TO MINIMIZE NOISE
Vertiflite, v 17 n 2, Feb 1971, p 4-9

Test results show that when the helicopter operates without blade slap, the altitude necessary to avoid exceeding noise code limits is one half the altitude necessary with blade slap. If the helicopter flies at the same altitude, the use of quieter operating techniques can reduce the ground area exposed to the same noise level by as much as 75 percent, and can reduce the required distance between a heliport and a noise - sensitive area boundary line by 50 percent. These reductions in noise exposure result in greater use of the helicopter's unique capabilities without exposing noise- sensitive areas to high noise levels. 5 refs

Melinikov, B. N.; Mkhitaryan, A. M.; Tokarev, V. I.; Shmakov, I. P.
CALCULATION OF NOISE-OPTIMUM CLIMB-OUT PATHS FOR AIRLINERS.
Sov Phys, Acoust, v 19 n 2, Sep-Oct 1973, p 191-192

Computer calculations of noise-optimum takeoff profiles for the TU-134 and IL-62 jet airliners are discussed. 4 refs.

Effects-

Pande, L.; Lyon, R. H.
MODEL STUDY OF AIRCRAFT NOISE REVERBERATION IN A CITY STREET
Acoust Soc of Amer NY J, v 52 n 1, July 1972, p 112-188

Experimental studies of sound propagation from a source situated above roof top level in an urban environment indicate the amplification and shielding effect of buildings. These experiments supplemented by diagnostic tests with a spark source which indicate the paths of propagation and their contribution to the received sound. A criterion for reverberation in a city street due to an aircraft is developed in terms of images formed. Charts indicating the amplification or shielding of noise from low flying aircraft are presented.

Cant, S. M.; Breysse, P. A.
AIRCRAFT NOISE INDUCED VIBRATION IN FIFTEEN RESIDENCES
NEAR SEATTLE-TACOMA INTERNATIONAL AIRPORT.
Amer Ind Hygiene Assoc, J, v 34 n 10, Oct 1973, p 463-468

Wall acceleration (in units of gravity (g) RMS) levels were investigated in 15 single-family dwellings near the Seattle-Tacoma international airport. Levels measured during a 24-hr continuous sampling ranged from

0.0025 to 0.22 g RMS. Background levels were lesser than 0.0018 g RMS. Although acute adverse health effects and major structural damage are not likely, aircraft noise induced vibration creates a nuisance problem for residents near a major airport.

Propagation and Absorption-

Bishop, D. E.; Simpson, M. A.; Chang, D.
EXPERIMENTAL ATMOSPHERIC ABSORPTION VALUES FROM AIRCRAFT FLYOVER NOISE SIGNALS
NASA Contract Rep., CR-1751, June 1971

A detailed analysis of the noise recorded on the ground during a series of 20 aircraft flyovers by two aircraft (a four-engine turbojet transport and a four-engine piston transport) during a single day of field measurements has been conducted. Noise levels recorded at five positions under and to the side of the flight path were acquired from the field tests. Differences in one-third octave band noise levels observed at different ground positions for the same angle of radiation from the aircraft were utilized to obtain sets of absorption values. 7 refs.

Delany, M. E.; Bazley, E. N.
NOTE ON THE EFFECT OF GROUND ABSORPTION IN THE MEASUREMENT OF AIR-CRAFT NOISE
J Sound Vibr, v 16 n 3, June 8 1971, p 315-322

It is shown that results of available theoretical analyses of the farfield sound pressure due to a simple source above an absorbing plane are capable of simple interpretation, and that certain published experimental values of excess attenuation obtained from measurements near the ground are consistent with such results. The effects of changing various parameters are demonstrated and estimates made of the errors likely to be incurred if effects of ground absorption are ignored when determining normalized values of the noise of aircraft. 13 refs.

Thompson, J. R.; Shapiro, N.
THE EFFECTS OF TEMPERATURE INVERSIONS ON AIRCRAFT NOISE PROPAGATION
Acoust Soc of Amer, Menasha, Wis, J, v 52 n 5, Nov 1972, p 1309-1317

Aircraft flyover noise measurements often must be made when normal temperature lapse rates exist. Inversion conditions might affect propagated noise appreciably. The two possible effects of temperature gradients are ray bending resulting from the associated sound velocity gradient and changes in atmospheric absorption. Each of the inversion effects is small, considering normal measurement scatter, and the net effect of the two is usually even smaller. Flyover noise measurements when temperature gradients were changing confirmed that there is no significant effect on perceived noise.

Survey-

Hurdle, P.; Lane S. R.; Meecham, W. C.
JET AIRCRAFT NOISE IN METROPOLITAN LOS ANGELES UNDER AIR ROUTE CORRIDORS
J Acoust Soc Amer, v 50 n 1 pt 1, July 1971, p 32-39

A survey is made of the average level of noise intrusion due to jet aircraft flyover noise and of the average number of people affected in metropolitan Los Angeles. Approach and departure routes are shown and the relation of present data to noise ordnances given.

Muller, J. L.
CALCULATION OF AIRCRAFT NOISE DURATION
J Sound Vibr, v 16 n 4, June 22, 1971, p 581-592

The problem of calculating the effective noise duration at any specific observation point during an aircraft fly-past is considered. Existing proposals are reviewed and the results of alternative methods of calculation are compared with each other and with analyses of actual noise history recordings. 9 refs.

Helicopter and Flyover Noise-

Faulkner, H. B.
COST OF NOISE REDUCTION IN INTERCITY COMMERCIAL HELICOPTERS
J Aircr, v 11 n 2, Feb 1974, p 89-95

The relationship between noise reduction and direct operating cost was studied for commercial helicopters having a design range of 400 miles. This was accomplished by generating a large number of helicopter preliminary designs with the aid of a computer program. Desgins were selected to meet each of four noise level goals with minimum direct operating costs. Establishing a curve of noise level vs direct operating cost. This was repeated for several payloads and technology time frames. It was concluded that good economic performance can be expected of relatively quiet future helicopters which have low tip speeds and high solidity rotors. With a 25 percent increase in direct operating costs the takeoff perceived noise level at 500 feet for a 1975, 50-passenger helicopter can be kept below 80 dB PNL. The expected improvements in helicopter technology over the next fifteen years can offset the economic penalties due to noise reduction. 11 refs.

Leverton, J. W.
HELICOPTERS AND THE ENVIRONMENT.
Noise Control Vibr Reduct, v 5 n 2, March 1974, p 57-61

Chemical pollution, downwash effects, induced building vibration, etc, arising from the use of rotorcraft are negligible and thus the only form of pollution of any significance is noise. In this respect rotorcraft have many advantages over other forms of transport, because of their inherent flexibility with regard to the flight path used during landing and takeoff. This means that the spread of noise can be controlled at will and the flight directions readily changed to avoid noise sensitive areas. Also because of the vertical lift-off and touchdown capabilities of rotorcraft, requirements for heliports are minimal and they can easily be situated on top of buildings or over areas already used for other applicants. Even compared with railway stations the area required for a heliport is small.

Leverton, J. W.
ROTORCRAFT FOR ALLEVIATION OF THE AIRCRAFT NOISE NUISANCE.
Aircr Eng, v 44 n 1, Jan 1972, p 14-17

The noise generated by a convertible rotorraft during take-off and flyout blends in well with the structure of a city, it is therefore well suited to use at large urban sites. For city center operations, however, it does appear that compound or winged helicopters are necessary as low take-off noise as well as flyover noise is required. 11 refs.

Leverton, J. W.
SOUND OF ROTORCRAFT
Aeron, J, v 75 n 726, June 1971, p 385-397

The general characteristics of the sound produced by rotorcraft are reviewed, with particular reference to rotor noise. The relative importance of rotational (discrete frequency) noise and broadband noise is discussed and narrow-band analysis results are presented which show the changes in spectral content that occur with variations in lift and tip are included. 38 refs.

Meecham, W. C.; Lane, S. R.
NOISE INTRUSION FROM POLICE HELICOPTERS OVER LOS ANGELES COMMUNITIES
Acoust Soc of Amer, NY, J, v 53 n 1, Jan 1973, p 291-392

Measurements of police helicopter nosie were made during surveillance flights over communities in several cities in the Los Angeles area. Small light observation-type helicopters (Hughes 269 and 300 and Bell 206) are used for emergency and surveillance work by the police departments of most cities in the Los Angeles area, and by the Sheriff's departments in the southern California 7-county area. These helicopters typically fly over the various communities several times each day and during the late evening. hours. Operation of these heliocpters at 500-to 1,000-ft altitudes results in noise levels of 70-80 dB A in the residential communities. Helicopter flights over schools and colleges caused noise levels of 65-75 dB A inside the classrooms. This is 10-20 dB above the maximum allowable limit of the Santa Monica area, late night flights and search patterns caused noise levels of 100-115 EPN dB over hospitals and convalescent homes. These levels are in violation of municipal noise codes and exceed the federal landing noise limits for new jet aircraft.

These levels are in violation of municipal noise codes and exceed the federal landing noise limits for new jet aircraft.

Pierce, A. D.; Kinney, W. A.
THEORETICAL INTERPRETATION OF RECENT EXPERIMENTS OF HELICOPTER NOISE PROPAGATION IN URBAN AREAS
Acoust Soc of Amer, NY, J, v 53 n 1, Jan 1973, p 291-392

Recordings were made while a helicopter flew over an array of microphones placed in an open field and a similar array placed in the center of a street flanked by tall buildings. The differences between the 2 sets of data (intially lower, then higher levels for the urban data) are similar to that predicted previously from laboratory scale model experiments by Lyon, Pande, and Kinney. Theoretical explanation is attempted based on a geometrical acoustical model modified to include edge diffraction. A general expression is first derived for the effective gain due to building presence when sound is excited by a monochromatic point source. This is then used to find the mean and variance of octave band filtered broad band noise for random listener location near the buildings and near the center of the street. The data are then discussed in terms of these theoretical predictions.

Propulsive Lift Aircraft Noise

Cheeseman, I. C.; Judd, M.; Lilley, G. M.
SOCIAL AND INDUSTRIAL IMPLICATIONS OF V/STOL TRANSPORTATION SYSTEMS.
Br Air Line Pilots Assoc, 11th Annu Tech Conf, V/STOL in Civil Aviation, London, Engl, Nov 24-26, 1970, p 142-169

It is shown from recent analyses of passenger travel and travel habits that V/STOL is viable as compared with other transport systems for journeys as short as 75 km. V/STOL is not a costly system and its direct operating costs can be made comparable with other forms of transport. The advantages of possible V/STOL integration with other transport systems are emphasized. The quality of the environment in relation to atmospheric and noise pollution is briefly considered. Some special problems with respect to atmospheric pollution for certain classes of V/STOL aircraft are noted. 11 refs.

Falarski, M. D.; Koenig, D. G.; Soderman, P. T.
ASPECTS OF INVESTIGATING STOL NOISE USING LARGE-SCALE WIND-TUNNEL MODELS.
Can Aeronaut Space, J, v 19 n 2, Feb 1973, p 61-69

The reverberant field of the test section must be determined with an acoustically similar noise source. A directional microphone, a phased array of microphones, and extrapolation of near-field data to far-field are some of the techniques being explored as possible solutions to the directivity loss in a reverberant field. The model sound pressure levels must be of sufficient magnitude to be distinguishible from the wind-tunnel background noise. 8 refs.

Marshal, E. E.
STOL AIRCRAFT IN FUTURE TRANSPORT SYSTEMS
Aeron J, v 75 n 730, Oct 1971, p 695-704

In this analysis of the greater London area, travel characteristics and habits are examined in the context of possible solutions afforded by STOL aircraft to land use and noise problems affecting airport planning. An airport system for the United Kingdom and the London area is suggested together with a proposed STOL airliner design to meet these requiremnts.

O'Keefe, J. V.; Nickson, T. B.; True, H. C.
A COMPARATIVE STUDY OF AUGMENTOR WING, EJECTOR NOZZLE, AND POWER JET FLAP LOW-NOISE STOL CONCEPTS
Acoust Soc of Amer, NY, J, v 53 n 1, Jan 1973, p 291-392

A noise and performance comparison of STOL airplane configurations is summarized. Aircraft were sized for a 2,000-ft takeoff field length, 150 passengers, and a STOL range of 500 miles. A discussion of thrust augmentation ratios, airplane thumb printing sizing, thrust requiremnts, thrust lapse rates, static test configurations, 500-ft SL noise comparisons, and noise footprints is presented for each concept. Each concept originally showed approximately equal noise levels on a static test stand but more intensive test work shows that the augmentor holds superior potential for low noise.

Rosen, G.
AN ENGINE FOR QUIET STOL PROPULSION
Astronautics & Aeronautics, v 9 n 12, Dec 1971, p 50-55

Through superior noise characteristics, weight advantage, fast response and reduced fuel consumption, the now-emerging Q-FANTM engine should greatly help clear the way to creating a viable short-haul air systems.

Rulis, R. J.
STATUS OF CURRENT DEVELOPMENT ACTIVITY RELATED TO STOL PROPULSION NOISE REDUCTION.
SAE Prepre, n 730377 for Meet April 24-26, 1973, p 14

The noise goal of 95 PNdB for STOL aircrafct imposes severe technology demands on propulsion systems. Effects of this goal on the design of the propulsion system are reviewed. Results from recent development programs associated with STOL nosie reduction, such as high by pass fan tests, 25 PNdB acoustic suppression tests, sonic inlets, and powered lift systems noise tests, are presented. Integrated propulsion system designs for the blown flap and augmentor wing powered lift systems capable of meeting the noise goal are shown and the performance, installation, and economic penalties assessed. 10 refs.

Scholten, R.
INFLUENCE OF THE GROUND ON THE NEAR FIELD NOISE LEVELS OF JET-SUPPORTED V/STOL AIRCRAFT.
Agard Conf Proc, n 113 for Meet Sept 26-27, 1972

A method for calculating the near field noise level of a free jet (without ground effect) by means of a modified Lighthill theory using measured reference sound fields is explained. The possibility of determining, with sufficiently good practical accuracy, the frequency spectra in the near sound field by means of a modified Strouhal number is described. The validity of the "Modified Lighthill Theory" is proven by means of two greatly differing engines jets. A discussion of comprehensive measured data of "Wall Jet Sound Fields" (sound fields of an engine jet directed vertically towards the ground) and the influence of the essential parameters affecting the sound field are discussed. Finally, it is demonstrated on the V/STOL aircraft dornier DO 31 that the ground effect can lead to a considerably increased noise level. 6 refs.

Stephenson, R. L.
NOISE LEVEL WHICH MIGHT ARISE FROM AIRCRAFT OPERATING BETWEEN THE CENTRAL AREAS OF CITIES
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congresses, 1971, p 16-22

Airport access from city centers by helicopter is discussed. These helicopters, short take-off and landing and advanced technology vertical take-off and landing aircraft, offer a great advantage in that they could operate from sites which need only be a fraction of the size of the conventional airport. Feasibility studies of the operation of these types of aircrafts were made by the British aircraft manufacturers. The standard of acceptable noise levels from the helicopters being discussed in 90 PNdB at 500 m and 85 PNdB at 830 m. Manufacturers consider that the figure of 90 PHdB at 500 m is a design possibility for aircraft which might economically carry beween 100 and 200 passengers. Studies of potential sites in the United Kingdom have shown that areas of 500 m radius which are not sensitive to noise can be found in central areas of cities.

VTOL-

Abdelhamind, A. N.; Schaub, U. W.
UNSTEADY FORCES AND NOISE FROM FAN-IN WING MODEL IN CROSS FLOW
ASME Paper 72-GT-92 for Meeting March 26-30, 1972,

Based on experimentally determined inlet and outlet flow distortions the unsteady forces on the rotor blades are determined analytically taking into account the effects of blade angle of attack and blade camber.

Results of unsteady forces due to flow distortions are compared with those on the rotor blades due to potential interaction with the stator vanes. The calculated unsteady forces on rotor blades are used to calculate the discrete frequency nosie emission characteristics of the fan. 7 refs.

Bartlett, F. D.; Flannelly, W. G.
APPLICATION OF ANTIRESONANCE THEORY TO HELICOPTERS.
J, Amer Helicopter Soc, v 19 n 1, Jan 1974, p 11-15

Results show that antiresonances can be determined by matrix iteration techniques. Antiresonant nodes introduced by dynamic absorbers and antiresonant isolators have been discussed to illustrated the novel application of the theory to helicopter engineering problems. 7 refs.

Bestek, H.
HUBSCHRAUBERLAERM. GRUNDLAGEN DER SCHALLERZEUGUNG UND BEWETUNG VON HUBSCHRAUBERN. BERECHNUNG DES GESAMTSCHALLPEGELS. (HELICOPTER NOISE FUNDAMENTALS OF HELICOPTER NOISE GENERATION AND RATING. CALCULATION OF THE OVERALL SOUND PRESSURE LEVEL).
Dtsch Luft Raumfahrt, DLR-MITT 73-18 1973, p 102

A survey of a large number of reports on noise generated by helicopters is presented. The paper gives a comprehensive review of the generation and rating of heliocpter noise. Sound radiation of main and tail rotors, piston, gas turbine, and tip jet engines, gears and transmissions is treated. Methods for calculating the overall sound pressure level are presented and discussed. 109 refs. In German with Egnlish Summary.

Casalegno, L; Martini, G.; Ruspa, G.
USE OF MODELS TO ESTIMATE FUSELAGE PRESSURE IN VTOL AIRCRAFT
J Sound Vibr, v 17 n 3, August 8, 1971, p 309-321

Near-field noise measurement results on the quarter-scale model of the V/STOL VAK 191 B aircraft are presented and discussed for the three take-off configurations-CTO, STO and VTO. The agreement proves to be quite satisfactory, mainly in the conventional take-off condition, while in the short and vertical take-off configurations some differences appear, due to the presence of jets blowing on the ground.

Cheeseman, I. C.
NOISE OF ROTORCRAFT AND OTHER VTOL AIRCRAFT. A REVIEW
Aeron J, v 75 n 726, June 1971, p 406-412

In order to meet expected target levels of allowable noise for V/STOL aircraft, this paper reviews nosie sources, prediction methods for various aircraft classes, and suggests the noise reduction which might be possible in the near future. Design penalties which might be incurred in designing.

to a fixed noise level are noted. Only limited coverage is given to fan and jet lift aircraft and to the noise contribution from shaft drive engines in rotor/propeller schemes. 25 refs.

Stepniewski, W. Z.; Schmitz, F. Z.
POSSIBILITIES AND PROBLEMS OF ACHIEVING COMMUNITY NOISE ACCEPTANCE OF VTOL
Aeronautical J, v 77 n 750, June 1973, p 311-326

General trends of acceptable noise level standards, as well as particular investigations of two typical suburban communities wer studied. New strides in acoustical technology are needed to bring vtol transport service directly to residential areas. Reduction of the noise level at the source by more than 10 dB of perceived nosie from the current state of the art for the rotary-wing and by twice as much for the lift-fan transport aircraft appears mandatory. Flight trajectory management can reduce the noise heard at specified measuring locations. The relative effectiveness of the noise abatement flight trajectories is dependent upong scenarios of the proposed vtol ports. Population distribution and ambient noise levels of the surrounding area are important in predicting community reaction to acoustic annoyance.

Design Studies-

Hayden, R. E.
FUNDAMENTAL ASPECTS OF NOISE REDUCTION FROM POWERED-LIFT DEVICES.
SAE Prepr, n 730376 for Meet April 24-26, 1973

Proposed powered-lift stol aircraft are expected to require noise reductions on the order of 20 dB to meet community noise goals, according to a number of model and full scale studies. Powered-lift stol introduces to the designer a new class of noise problems in that the noise sources are exposed and not amenable to conventional muffling. Thus, the nosie must be reduced at the source, a task for which thorough understanding of source mechanisims is required. A review of source mechanisms associated with various powered-lift concepts is presented and current state-of-the-art of prediction technology is assessed for each important source. Sources are rank-ordered for the various classes of lift-augmenting concepts. Parametric dependence of source levels on design and operating parameters is discussed. Fundamental concepts for noise reduction are developed and current progress toward implementation of these noise reduction concepts is reviewed.

Sweet, H. S.; Leslie, H. R.; Bennet, J. A.
DESING STUDIES OF LOW-NOISE PROPULSIVE-LIFT AIRPLANES.
SAE Prepr n 730378 for meet April 24-26, 1973

A review is presented of low-noise airplanes designed for operation in the 1980 time period. Powered-lift concepts include externally blown flap, augmentor wing, internally blown flap, and over-the-wing upper surface blowing. Performance, sizing, and costs are described for 148 passenger airplanes with design field length varying from 2000-4000 feet. Techniques for reducing noise are evaluated in terms of aircraft performance weight, and cost. Experimental data on decayer nozzles are presented and assessed with respect to effectiveness in exhaust noise reduction and aircraft performance penalties. Noise footprints for aircraft with different lift concepts and different field length capabilities are discussed from the standpoint of community acceptance of STOL short-haul service at existing carrier airports, general aviation airports, or dedicated new Stolports. Recommendations are made for further work in development of rational criteria for short-haul noise levels and for areas that hold promise of further noise reduction. 11 refs.

Airport Noise

Noise Contours-

Galloway, W. J.
PREDICTING THE REDUCTION IN NOISE EXPOSURE AROUND AIRPORTS.
Inter-noise 72. Intl Conf on Noise Control Engr Proc, 1972, p 2-4

A model for evaluating the gross effects of various aircraft fleet operations on airport noise exposure is proposed. The model can be used for assessing policy implications, but it should not be employed for detailed planning at specific airports. Area coefficients may be used to examine alternate fleet configuration effects at specific airports. The coefficients may be used for individual airport planning. An initial detailed analysis for a 'base case' condition at the specific airport must be made.

Igarashi, J.; Nishinomiya, G.
DETERMINATION OF NOISE EXPOSURE AROUND AN AIRPORT.
Inst Space Aeronaut Sci, Univ Tokyo, Rep n 476 March 1972

This paper presents a study of drawing the noise exposure contour around an airport. The contour was figured out from the measured data obtained in the vicinity of Osaka airport. It is compared with the calculated contour based on the data of FAA, the specified flight paths and the scheduled operations similar to those of the period of measurements. The methods of determination of PNdB, duration and tone corrections are also mentioned together with the relation between PNdB and dB or dBA.

Kajland, A. R.
A STUDY OF FACTORS DETERMINING THE PROPAGATION OF AIRCRAFT NOISE
Acoust Soc of Amer, Mensha, Wis. J, v 52 n 5, Nov 1972, p 1309-1317

Tape recordings were made of about 1,500 takeoffs at Arlanda airport (Sweden). Type of aircraft, destination, temperature, air humidity, wind velocity, and direction were registered. A correlation analysis of peak sound level in dBA and meteorological factors was made. Sound level showed no significant covariation with humidity and temperature, but there was a positive correlation to the wind velocity from the aircraft toward the measuring station. The mean values measured verify theoretical calculation of the sound level from standard noise carpets. Calculations are more significant than occasional measurements.

Spencer, J. A.; Meyer, T. H.
COMPUTER GENERATED AIRPORT NOISE CONTOURS
Acoust Soc of Amer NY, J, v 53 n 1 p 291-392, 1973

Exisitng airport noise prediction programs are incapable of delaing with complex flight paths and normal dispersion of flight paths due to variations in aircraft gross weight and pilot technique. A computer program that is capable of handling these problems has been developed, using an air traffic control simulation program as its base. The original air traffic control program is capable of very accurate simulation of aircraft motion in an airspace, including random deviations from assigned parameters and automatic metering of traffic using holds, delaying turns, etc. A grid of noise measuring points, of arbitrary extent, is superimposed on the airspace and constant recording of aircraft noise at each location is simulated. At the end of a run, a contour plot of noise levels in the grid area is produced. Variations in traffic density, controller technique, traffic patterns and runway use can be simulated, and the results of such variations compared directly.

Blomberg, S.
ARLANDA AIRPORT, THE NOISE SITUATION NOW AND IN THE FUTURE.
Inter-noise 72. Intl Conf on Noise Control Engr Proc, 1972, p 2-4

Swedish criteria for airport noise are reviewed, and critical noise limits and levels at Arlanda airport are discussed. Noise may be reduced by a retrofit program and a new airport with two parallel E-W runways to be built immediately N of the present airport.

De Wit, G. A. M.
ON THE NOISE IN THE VICINITY OF THE BRUSSELS NATIONAL AIRPOT.
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congress.
1971

In the vicinity of the Brussels national airport, a number of measurements were carried out on the noise that aircraft taking-off caused on the ground. The measurement results, which concern principally the noise levels, the difference values between PNdB and dBA, the period of flyover, and the influence of noise abatement climb, are represented and briefly discussed.

Meecham, W. C.; Lane, S. R.
HAZARDOUS JET NOISE RADIATION AT SCHOOLS NEAR LOS ANGELES INTERNATIONAL AIRPORT
Acoust Soc of Amer, NY, J, v 53 n 1 Jan 1973, p 291-392

Indoor and outdoor measurements of jet aircraft noise were obtianed at 7 schools beneath the eastern approach paths to Los Angeles International Airport. At 5 elementary schools, the jet noise in the schoolyards ranged from 100 to 120 dBC and constituted a high risk of hearing damages for the young children. The frequency of jet aircraft overflights averaged 1/2 min for a total of over 200/school day. The corresponding jet noise levels in the classroom, 80 percent of which were not air conditioned or acoustically treated, ranged form 80 to 96 dBA, and caused total disruption of the communication and learning processes. The noise could be reduced by 10 dB or more if engine power were reduced when the aircraft approached the school areas, or if the aircraft approached at higher altitudes and landed further to the W on the unused 6,000 ft-long portion of the 12,000-ft-long runways.

Reichow, H. B.
EIN NEUARTIGER BAULICHER LAERMSHUTZ FUER DIE STADT KEISTERBACH AM RANDE DES FLUGHAFENS FRANKFURT A.M.
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congresses 1971, p 16-22

Inhabitants of the town of Keisterbach, Germany, N of Frnakfurt airport are harassed by noise of takoffs and expansion contruction of the airport --expecially 45 freight loading places and a new W runway. Construction of a series of hangars, and administrative and clearance buildings, while utilizing 15 m high sound protection wall with a sectioned, horizontal absorption plate on the upper side, was recommended as a practical means to reduce the noise. Because of the nearness of this wall to loading places and runways, this measure aims at sound absorption and deflection resulting in a protective action which is more effective than that of sound protection barriers. The airport administration has resolved to adopt this suggestion and to execute, by stages, construction of the sound protection wall totaling a length of 3.8 KM.

Rettinger, M.; Green, D. W.
A PROPOSED LITTORAL AIRPORT
Inter-noise 72. Intl Conf on Noise Control Engr Proc, 1972, p 2-4

A proposed offshore airport in San Pedro, California is described. Variation of aircraft noise level with distance, noise reduction achieved by a two-segment approach pattern, community noise equivalent levels, and noise exposure forecasts are discussed. An 11-fold reduction in loudness would be achieved by a littoral landing field, and maintenance cost reduction would be accomplished by exploitation of submarine oil deposits and remuneration obtained from a pleasure boat harbor and commercial docking facilities. Access to the airport would be by causeway, hydrofoil, monorail, and subterranean passage.

Shapiro, N.
COMMUNITY NOISE LEVELS OF THE L-1011 TRISTAR JET TRANSPORT
Acoust Soc of Amer, NY, J, v 52 n 1 July 1972 p 112-188

In order to halt the escalation of aircraft noise in the vicinity of airports, the Federal Aviation Administration (FAA) developed, and in late 1969 issued, the noise certification standards of FAR Part 36. The Lockheed L-1011 Tristar, a wide-bodied trijet transport, was planned not only to meet the anticipated FAA requirements, but to provide the quietest community environment that was technologiecally practicable and economically reasonable. Powered by Rolls-Royce high bypass ratio engines, with quiet operation a major design goal, and utilizing specially designed acoustical lining for its nacelles, the L-1011 demonstrated flyover noise levels substantially lower than the FAA specified limits, and also measurably lower than those of competitive airplanes. As a result, community annoyance levels were achieved that are 65-75 percent below those of the presently operating older jet transports.

Annoyance-

Anon.
THE UNBEARABLE MENACE - AIRPORT NOISE.
J of Envr Health, v 35 n 6, May-June 1973, p 578-583

The physical and psychologic effects of noise are discussed, along with the characteristics of annoying sound: loudness, pitch, intermittency, irregularity, and localization. Aircraft noise fits all critieria for annoying sound. Complaints include the interference with speech and the disturbance of sleep and relaxation. Studies regarding sleep and aircraft noise are reviewed, and conclusions regarding noise impacts on schools near airports are summarized.

King, R. L.
AIRPORT NOISE POLLUTION: A BIBLIOGRAPHY OF ITS EFFECTS ON PEOPLE AND PROPERTY
Metuchen, J. J.: Scarecrow Press, 1973

A bibliography on the effects and control of airport noise is presented. The general, psychological, and physiological effects of aircraft noise on human health were investigated. The control and abatement studies that were discovered included the measurement of noise, legal aspects of control, aircraft noise control, airport noise control, architectural noise control, and land use and zoning controls. Property values around airports were also examined. The appendix identifies organizations concerned with noise pollution research and control. The activities and current research of these organizations are outlined. The organizations include U. S. government agencies, state and local governments, universites, research institutions professional associations, civic organizations, business organizations, and international and foreign organizations.

Kiro, D.; Fehr, U.; Burnstein, M.; Iron, B.; Goldman, J.
EXPOSURE OF COMMUNITIES OF LOW-FREQUENCY NOISE FROM AIRCRAFTS AND ROCKETS
Acoust Soc of Amer, NY, J, v 53 n 1 Jan 1973, p 291-392

Data collections in the LF noise region (below 100 CPS), in communities located near airports are analyzed for the purpose of volumetric coverage. Isosurfaces of sound pressure level of jet planes at altitudes of up to 7,000 ft are shells in the shape of pears, with the top directed toward the ground. The top covers a minimum area of 12,000 KM^2. The pear-shaped envelope is pulled in the direction of the flight, and this produces a time delay and altitude dependence between the community exposure to radiated noise, and the instantaneous location of the plane. Typical time exposures for altitudes of 1,000 to 7,000 ft are 45-74 sec. This LF does not raise complaints because of the human ear's limitations; nevertheless they might be harmful. Furthermore, infrasonic frequencies (4 cps and below), having energies of 100 dB and more, cover 10,000 KM^2 and have durations of up to 30 min. If these frequencies are harmful or bothersome, the jet engines should be designed to dissipate these engergies at higher frequencies which attenuate strongly and do not propagate long distances in the atmosphere.

Johnston, G. W.
V/STOL COMMUNITY ANNOYANCE DUE TO NOISE PROPOSED INDICES AND LEVELS FOR TORONTO-YORK TRANSPORTATION COMMITTEE.
Toronto Univ, Inst Aerosp Stud, Utias Tech Note n 177 March 1972,

The objective is to define suitable community noise assessment techniques applicable to V/STOL systems by incorporating current community disturbance methods and experience to a maximum with suitable modifications to accommmodate important new noise features implicit to V/STOL systems. The study includes a brief review of current applicable psychoacoustic work relating to: methods for assessing subjective response to individual noise events EM -- including speech interference; indices for assessing total noise exposure; criteria for assessing noise disturbance, due to V/STOL operations is then proposed, together with maximum criteria levels. Finally, a computer program has been developed and preliminary computer studies carried out, at a hypothetical urban STOL port location, to establish the feasibility of the proposed methods. 31 refs.

Richards, E. J.; Ollerhead, J. B.
NOISE BURDEN FACTOR - NEW WAY OF RATING AIRPORT NOISE.
SV Sound Vibr, v 7 n 12, Dec 1973, p 31-33

The assessment of noise annoyance by a comparative methodology of noise problems at different airports in major U. S. cities is discussed. The methods of monitoring are reviewed. The factor defined as "The number of man days of serious annoyance per passenger movement" is studied along with alternative criteria to establish a concept for comparison. 5 refs.

Stephenson, R. J.
SOCIAL ACCEPTABILITY OF HELIPORTS PARTICULARLY FROM THE STANDPOINT OF NOISE.
Aeron, J, v 77 n 749, May 1973, p 217-220

Noise levels of helicopters are compared with other sources of acoustical nosie. The following results were charted from measurements taken at from 500 to 1500 feet from the helicopter: take off (81 dBA to 71 dBA), landing: (79 dBA to 69 dBA) and fly over (74 dBA at 500 feet and 68 dBA at 1000 feet). Air pollution, downwash or dust movement do not pose problems.

Monitoring-

Bricken, F.; Hilliard, J. K.
DESING AND OPERATION OF A CONTINUOUS, AREAWIDE AIRCRAFT-NOISE MONITORING SYSTEMS.
Acoust Soc of Amer, NY, J, v 52 n 1 July 1972, p 112-188

A five-station permanent, 24-hr centralized aircraft noise monitoring system was installed in the community surrounding Orange County airport. Santa Ana, California. A discussion is presented of the design concept, the results obtianed from initial tests involving measurement of over 1000 flights, the practical experience gained from the installation, the true value to the community, and the potential for effective noise management programs. The measurement data will be used to demonstrate the value of the California noise index CNEL.

Hurlburt, R. L.
SMALL TOWN MONITORS BIG AIRPORT NOISE
Pollut Engr, Greenwich, Conn, v 4 n 5, Aug 1972, p 30-32

Because of its proximity to the Los Angeles International Airport, the city of Inglewood initiated a comprehensive noise abatement program. A noise monitoring system which includes a fixed network of 4 remote microphones and a central recording station, and a mobile acoustic laboratory for recording all aspects of individual noise events, particularly aircraft flyovers, was put into operation. While data from the fixed monitors indicate a trend toward decreased noise exposure from 1 station under the flight path to a landing runway, initial results of a community-wide general survey conducted with the mobile unit show a wide variation of composite noise values with the readings under the flight paths far in excess of the California standard for a reasonable level of noise in the vicinity of an airport. Solutions to the problem will require some action on the part of the city, such as land use planning and soundproofing, as well as action on the part of the aviation industry, such as steeper approach profiles and quieter engines.

General Interest-

Hartenstein, L.
INTERNATIONALER KONGRESS WELTFLUGHAEFEN--DER WEG IN DIE ZUKUNFT
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congresses
1971

A report of the international congress regarding airplane noise, held in London in September 1969, is presented. Topics covered include the increasing number of airline passengers, the development of air freight, the planning of airports; aspects of noise related problems are also considered.

Hilliard, J. K.; Bricken, C.
AIRPORT NOISE MANAGEMENT
Audio Engr Soc, 40th Conv and Exhib, April 27-30, 1971, Los Angeles, Calif
AES Prepr n 781, (B-5)

Noise management is a total concept which includes reduction in the source of the noise itself, control of the time of day aircraft depart and arrive, number of flights during a day, management of load factors airlines use, management of land use around airports, and establishment of building codes for facilities within the noise area around an airport. A system is described to provide the required information for the noise management oulined.

Hinton, L.
AIRCRAFT NOISE AS A CONTINUING NATIONAL PROBLEM
Soc of Automotive Engr, NY, J of Automotive Engr, v 80 n 7 July 1972, p 76

The history of the aircraft noise problem is presented using many references to particularly important studies. Emphasis is placed upon the similarity of expert opinions during 20 years of research for measures needed to resolve the problem. The views of noise impacted airport-community residents who cannot comprehend the lack of progress in aircraft noise abatement are represented. This lack of progress has persisted in spite of general agreement on measures needed, and is the basis of a call for the reallocation of authority among federal agencies having responsibility both for the regulation of aviation and for the planning and development of urban areas, including airports, with environmental protection as basic criterion.

Hurlburt, R. L.
NOISE IN AN AIRPORT COMMUNITY
Inter-noise 72, Intl Conf on Noise Control Engr, Proc, p 2-4, 1972

The effects of noise from aircraft landing at Los Angeles International Airport on the city of Inglewood are reported. The approaches of aircraft landing at San Diego International Airport were compared to those of aircraft landing at the Los Angeles Airport. Noise would be reduced 56 percent if aircraft approaches of 5 degrees were flown at the Los Angeles Airport. A community noise monitoring network is described. High noise levels are correlated with low land values and high vacancy rates in Inglewood. A proposed city ordinance requiring acoustical treatment of new residences under or near flight paths is considered.

Waters, C. S.
AIRPORT NOISE CONTROL - AN ASSURED FUTURE?
Noise Control Vibr Reduct, v 5 n 2, March 1974, p 77-79

To reliably devise a system of assessing the impact of aircraft noise upon a population it is necessary to relate the physical characteristics of the noise to the subjective reaction of the community. A carefully designed examination of a set of verbal responses will elicit information regarding an individual's reaction to noise. It was this latter technique which was initiated by the Wilson committee in 1961 in their study of the reactions of the population to aircarft noise in the area around London (Heathrow) airport. From the physical measurements of aircraft noise 14 different variables could be picked out as characterizing the noise climate and 58 socio-psychological variables could be identified from the answers to the questionnaire. Subsequent correlation analysis reduced the physical variables to two, that of noise level and the number of occurrences of the noise during the day. The results of this work defined an index which became termed the Noise and Number Index (NNI).

Prediction and Measurement

Engine Noise-

McNeill, H.
DIGITAL DATA REDUCTION METHODS FOR AIRCRAFT ENGINE NOISE ANALYSIS.
S) V, Sound Vibr, v 6 n 4 April 1972, p 26-29

Digital data reduciton methods for analyzing turbofan engine noise characteristics are discussed. The approach is superior to those employing analog electronic analyzers becasue of reduced analysis time, lower cost, and improved information exchange resulting from the analytical technique standardization that is possible. Analysis of a fan noise spectrum exemplifies application of the digital data reduction method.

Zabriskie, C. J.
DIAGNOSTIC SONICS FOR GAS TURBINE ENGINES.
ASME Paper n 74-GT-18 for meet March 30 - April 4 1974

Sonic analysis is very similar to vibration analysis. A gas turbine engine produces an acoustic spectrum which reflects the rotating speed and geometric relationships of the various rotating components. Additional acoustic energy is released every time a disparity or fault comes in contact with another surface. The frequency and characteristic of these signals can be used to isolate faulty components. The sonic analysis concept is based on employing narrow band filtering to separate the discrete signals from the noise components to determine signal characteristics relative to amplitude, harmonic, and modulation content. When a part or component begins to wear or go through some other physical change, the character of the acoustic signal is altered. By monitoring the characteristics of all the discrete frequencies produced by the rotating components, it is possible to detect changes in the mechanical condition and to pinpoint the individual component which is deteriorating. 4 refs.

Kriebel, A. R.
REFRACTION AND ATTENUATION OF SOUND BY WIND AND THERMAL PROFILES OVER A GROUND PLANE
Acoust Soc of Amer, J, v 51 n 1 Jan 1972, p 10-23

There is significant excess attenuation of sound traveling downwind within a typical turbulent shear profile due to downwind refraction and spreading of sound rays. This attenuation is in excess of that due to absorption by turbulent eddies, spherical spreading, and ground reflection. When the source and receiver are both located on the ground, excess attenuation of the directly transmitted sound due to refraction is predicted to be uniform at -11 dB beyond a short range downwind of the source until a shadow zone is reached at a much longer range. This predicted excess attenuation decreases markedly with the elevation of source and receiver, particularly at short range. Results show that wind can easily cause anomalous recording of the sound-pressure level from freeways, airports, and other urban noise sources.

Webster, W. J.; Russell, G. A.
MEASUREMENT OF ACOUSTIC ABSORPTION COEFFICENTS BY TONE BURSTS IN A NOISY ENVIRONMENT
Noise and Vibr Control Engr Conf, Proc, p XV-XXV, 1972

One of the most promising techniques in jet engine noise control is that of noise attenuation by means of duct liners in the engine inlet and exhuast areas. There is need for some means of measuring the absorption characteristics of potential duct lining materials while exposed to a strong broadband background noise. The feasibility of conducting pulse measurements of acoustic absorption in a noisy environment was investigated. Results show that background noise, although troublesome, is not an obstacle to tone burst measurement of acoustical absorption coefficients. It is, rather, the interpretation of pulse measurements, in the light of the transiet response of sample and instrumentation, which require further study.

Miscellaneous-

Bricken, G.
PREDICTION AND MEASUREMENT OF AIRCRAFT NOISE.
Inst of Environ Sci, Annu Techn Meet, 19th, Proc, Anaheim, Calif, April 2-5 1973 availbe from INST of Environ Sci, Mt. Prospect, Ill, 1973 p 97-102

This paper discusses contour representation of sound for airports, as well as how one proceeds to verify the predicted case by measurement. 6 refs.

Burhans, R. W.
AIRCRAFT INFRASONIC NOISE EVALUATION PROBLEMS.
J Audio Engr Soc, v 20 n 6, Jul - Aug 1972 p 492-493

A literature survey has been conducted on audio noise measurement and evaluation problems associated with aircraft operations. The results suggest that low-frequency or infrasonic noise has been largely neglected in most noise abatement studies, but that this may contribute to human disconfort in many situations well below the threshold of ear pain. 14 refs.

Leneman, G.
DETERMINATION OF MAXIMUM GROUND NOISE DURING A ROCKET LAUNCH - DISCUSSION AND SIMPLE PREDICTION METHOD.
Inst of Environ Sci, Annu Tech meet, 19th Anaheim, Calif, April 2-5 1973 Available from INST of Enuiron Sci, Mt. Prospect, Ill, 1973 p 327-328

Analysis of published sound pressure level data has resulted in the derivation of a simple equation (116 $\pm$ 10 log FI-20 log r) which predicts the maximum overall sound pressure level at a distance r from a vertical launch of a rocket vehicle with a thrust F and a specific impulse I.

Perceived Noise Level

Clarke, F. R.; Kryter, K. D.
METHODS OF PAIRED COMPARISONS AND MAGNITUDE ESTIMATION IN JUDGING THE NOISINESS OF AIRCRAFT
NASA Contract Rep n CR-2107 Aug 1972

The point of subjective equality in regard to perceived noisiness for each of 14 pairs of aircraft noises is obtained using both the magnitude estimation tehcnique and the method of paired comparisons. Both methods give approximately the same estimates of the points of subjective equality for the noise pairs, and both showed similar correspondence to predictive physical measures. Results are reported here.

Nekipelov, M. I.
FLIGHT NOISE OF AIRCRAFT AND THE SUBJECTIVE JUDGMENT OF ITS ANNOYANCE.
Sov Phys, Acoust, v 18 n 1 July - Sept 1972 p 58-63

The results are given from an experimental investigation of the takeoff noise characteristics of Kappa C TU-104 jet airliner in the far sound field. It is shown that the local flight noise spectrum varies in accordance with the doppler effect. A characteristic is given for the influence of nosie persistence, number of fly-overs, and population density on the subjective judgment of the noise annoyance factor. A method is described for calculating the persistence correction to the perceptible noise level. 18 refs.

Ollerhead, J. B.
SCALING AIRCRAFT NOISE PERCEPTION
J of Sound and Vibr v 26 n 3 Feb 8, 1973, p 361-388

An experiment was undertaken to assess the differences between alternative methods for calculating the perceived levels of individual aircraft flyover sounds; 120 recorded sounds, including jets, turboprops, piston aircraft, and helicopters, were rated by a panel in a pair comparison test. Noise rating procedures were evaluated in terms of their ability to accurately estimate both relative and absolute perceived noise levels over a wider dynamic range than was used in previous experiments. The complex procedures developed by Stevens, Zwicker, and Kryter are more accurate than the weighted sound pressure level scales, particularly when integrated to include a signal duration allowance, although their main advantage lies with their ability to cope with signals over a wide range of bandwidth. The differences between the various scales are small and the d-weighted sound pressure level scale provides a reliable estimate of perceived level over a wide range of bandwidths. When used with an integrated duration correction, it is more accurate than the effective perceived noise level scale.

Criteria

International Noise Certification-

Paullin, R. L.
STATUS OF INTERNATIONAL NOISE CERTIFICATION STANDARDS FOR BUSINESS AIRCRAFT
SAE Prepr n 730286 for meet April 3-6 1973

The status of domestic requirements in the United States and abroad is presented. Technical procedures of promulgated and proposed standards are discussed. Business aircraft are separeted into turbojet-powered and propeller-driven categories, and each is presented in terms of recent certification experience. The relationship between domestic certification programs and those of the international civil aviation organization, and between domestic and foreign programs are presented. Finally, a brief look is taken into the future for the efficacy of business aircraft noise certification programs.

Cost - Effectiveness-

Safeer, H. B.
AIRCRAFT NOISE REDUCTION--ALTERNATIVES VERSUS COST
Sound and Vibr, v 7 n 10, Oct 1973, p 22-27

The consequences of implementing alternative engineering and opertional strategies for reducing noise around airports are being analyzed for 23 U. S. airports to determine the increased costs involved and the reductions in noise impacted areas. Preliminary results are presented from the first six airports studied. Information is provided on retrofit effectiveness, combined effects of retrofit and operation procedures, population projections, and cost effectiveness.

Proposed Test Method-

Earls, D. L.
TECHNICAL PROGRESS ON NEW VIBRATION AND ACOUSTIC TESTS FOR PROPOSED MIL-STD-810C, "ENVIRONMENTAL TEST METHODS"
J Environ Sci v 16 n 4 Jul - Aug 1973 p 22-32

New random vibration procedures have been developed for jet aircraft equipment, for external stores and for their installed equipment. New acoustical noise tests have been developed for testing assembled external stores and for simulating cavity acoustic resonanace phenomena. The article contains an explanation of these new procedures along with a discussion of the technical basis for their development. 16 refs.

Engine Noise-

Sanders, N. D.
QUIET ENGINE FOR STILLING COMPLAINTS.
Astronaut Aeronaut, v 11 n 1 Jan 1973 p 40-48

Two experimental engines yield reduced nosie levels of from 14 to 17 EPNdB below FAR-36 with potential for further cuts. Because of high retrofit costs, probable application would be on the new trijet and twin-jet airplanes. Noise curves and other engine operating criteria are charted and fan design concepts to attenuate noise are described.

Scholz, N.
DIE UMWELTWIRKUNGEN VON TURBOFLUGTRIEBWERKEN. (ENVIRONMENTAL EFFECTS OF TURBOJET ENGINES)
Z Flugwiss v 20 n 9 Sep 1972, p 317-330

The harmful environmental effects of aircraft engines include heat, radiation, noise emission and exhaust gas generation. The serious environmental problem associated with turbojet engine design is that of noise emission. According to today's knowledge, noise abatement can only be achieved at the price of considerable reductions in engine performance On the research side extensive effort still needs to be made toward deepening the understanding of flow process and the associated generation of sound. The contribution of the turbojet engine to air pollution is in the order of 1 percent of total pollution emissions. Steps toward a further reduction of this amount will certainly keep pace with efforts for reducing the other pollution sources. In this connection the primary questions to be solved by research include the complex interactions of reaction kinetics and flow processes. 38 refs. In German.

Thomas, D.; Zarzycki, J.
ON THE EFFECTS OF QUIETER AIRCRAFT ENGINES ON NOISE NUMBER INDEX (NNI) VALUES
J of Sound and Vibr v 32 n 2 Jan 22, 1974, p 283-285

The effect of quieter aircraft engines on noise and number index (NNI) values at a given location was studied. An expression for the resultant change in the NNI is recorded and some of the numerical results are presented

Aircraft Related Noise-

Burrows, A. A.; Zamarin, D. M.
AIRCRAFT NOISE AND THE COMMUNITY: SOME RECENT SURVEY FINDINGS
Aerospace Medicine, St. Paul, Minn. v 43 n 1 Jan 1972 p 27-33

The results of two surveys conducted in the communities surrounding Los Angeles International Airport are presented. By means of indepth interviews, a qualitative and quantitative measure of respondents' attitudes toward aircraft noise and its effect on their lives was obtianed. Results are presented for awareness and disturbance from aircraft noise during daily activities, emotional reactions generated, complaints, economic effects, changes in aircraft noise over time, awareness of noise abatement activities, and so forth. In general, the major effect of aircraft noise was upon activities involving active or passive communication. A majority of respondents were not bothered or are only slightly disturbed by aircraft noise.

Shapiro, N.; Vogel, J. W.
NEW JUMBO JETS MUST SPEAK IN WHISPERS: CERTIFYING THE LOCKHEED 1011
Noise Control Engr. v 1 n 1 Summer 1973, p 16-23

The FAA's noise certification regulation (FAR-part 36) is forcing standardization and distinct improvements in flyover noise measurement technology and has established improved, but achievable, noise standards for aircraft. The regulation delineates, in great detail, instrumentation specifications, airplane performance restrictions, and measurements and analysis requirements. During the time that the government was developing, discussing, and reviewing the ideas that culminated in the regulation, the wide-bodied jet transports such as the Lockheed 1011 tristar came to the drawing boards. Low flyover levels were established early for this jet as a basic design consideration. The certification on the Lockheed 1011 is discussed, covering instrumentation, test site, data reduction and analysis, demonstration for the FAA, and results

Shapiro, N.; Vogel, J. W.
NOISE CERTIFICATION OF A TRANSPORT AIRPLANE
Inter-noise 72. Intl Conf on Noise Control Engr Proc, p 2-4 1072

The requirements of Federal Aviation Regulation (FAR) part 36 are described and the noise certification program for Lockheed's L-1011 tristar is examined. Noise levels for the RB211-22C engine and anticipated levels for the RB211-22B engine are significantly lower than the FAR limits and substantially lower than noise levels of earlier large jet transports. Improvements are needed in the techniques and procedures for measuring airplane flyover noise and for noise certifying aircraft.

Stevens, J. H.
COMBATING ARICRAFT NOISE
Environ This Month. The Intl J of Environ Sci. Lancaster Engr. v 1 n 1
July 1972 p 12-120

Specific sources of noise (efflux, internal, and fan) in different types of aricraft are examined, and measures being taken to reduce aircraft noise to within human tolerance levles are discussed. The impact of new noise regulations on existing aircraft and the design of future aircraft are also examined.

Martin, H. J.
DIE ICAO-FLUGLAERMKONFERENCZ VOM 25.11. BIS 17.12.1969 MONTREAL
Noise 2000 Assoc Internationale Contre Le Bruit. Intl Congresses p 16-22
1971

Discussions at the ICAO Conference on aircraft noise held in Montreal from November 25 - Decemeber 17, 1969, included description and measurement of aircraft noise, human tolerance of noise, noise certification, and land use control. Main features of a noise certification scheme are described. Progress in noise reduction achieved to date is pointed out and the results are assessed in terms of the possibilities offered by ICAO. The decisive achievement of the conference was the setting of this nosie certification scheme which, in the long run, should lead to considerable noise abatement.

Montanus, N. R.
THE PROBLEM OF AIRCRAFT NOISE
Amer Soc of Civil Engrs. Meeting Preprint 1753, (1972)

Industry and government should agree quickly to an aircraft noise control program that will bring quiet to communities. The 1st and essential step in such a program is to make Federal Avaition Regulation part 36 a national standard, applicable to the entire fleet at the earliest date posssible. This regulation is a noise standard for subsonic aircraft certificated after December 1969. The new aircraft, which meet this standard, are quieter than older jets. Commitment to Part 36 would provide assurance to the people that the noise environment would improve. A requisite complementary action would be the development of the means and appropriate timetable for compliance. As a further benefit, Part 36 would provide a geogrpahic definition to the noise problem. The next step would be the periodic revision of aircraft noise standards as they apply to new aircraft, with a view to establishing progressively lower permissible levels as noise reduction research progresses.

Orville, T. W. J.; Ball, D. F.; Houghton, R. R.; Chandler, T. J.; Brazell, J. H.; Sawyer, J. S.; Parker, J.; FFowcs, W. J. E.; Williams, M. R.; Craxford, S. R.; Weatherley, M. L. P. M.; Gooriah, B. D.
CLEAN AIR CONFERENCE.
Natl Soc for Clean Air 38th Annu Conf, 2 pts, Folkestone, Engl, Nov 2-5 1971 Natl Soc Clean Air, Brighton, Sussex, Engl, 1971, pt 1, p 124, pt 2

Eight papers were presented at the conference covering odor control, meteorological aspects of air pollution and pollution by aircraft. Following is a list of titles and authors. The Identification and Measurement of Gaseous Pollutants. By W. J. Orville-Thomas and D. F. Ball. The Removal of Odors and Obnoxious Substances from Air by Active Carbon. By F. R. Houghton, Air Pollution and Urban Climates. By T. J. Chandler. Weather and the Clean Air Acts. By J. H. Brazell. Pollution From Humactivity on the World Climate. By J. S. Sawyer, Pollution from Airports, Heathrow 1970-71. By J. Parker, The Engineer's Fight Against Pollution. (I) Aircraft Noise in the 1980's. By J. E. Ffowes-Williams L (II) Chemical Pollution from Aircraft. By M. R. Williams, Trends in Pollution. The National Survey of Smoke and Sulphur Dioxide, The First Ten Years. By S. R. Craxford, M. L. P. M. Weatherley and Gooriah, B. D.

Paullin, R. L.; Miller, J. F.
AIRCRAFT NOISE ABATEMENT. THE PROSPECTS FOR A QUIETER METROPOLITAN ENVIRONMENT
J Aircraft v 8 n 6 June 1971 p 444-449

Aircraft noise abatement is oriented toward compatibility between airports and the adjacent metropolitan environs. The effectiveness of tehcnical, operational, and land use strategies of noise alleviation, including proposed aircraft noise certification regulations, can be forecast. The impact of aircraft operations on people and communities near airports is presented specifically regarding land use planning and alternative land use options available for dealing with expected residual-noise-exposed areas subsequent to foreseeable noise reductions. 7 refs.

General Interest

Engine Technology-

Dugan, J. F., Jr.
AIRBREATHING PROPULSION SYSTEM TRENDS.
Astronautics & Aeronautics, v 9 n 11 Nov 1971, p 36-45

Major trends in airbreathing propulsion systems for various types of aircraft are discussed. Notable shifts in philosophy from a few years ago include the dominant role that noise plays in new engine designs and the inability to captialize on very high turbine temperatures because of the noise constraint. NASA plans a vigorous research and technology program on noise reduction until the noise reaches the goal of a level no greater than normal background noise. Developments in engine design and propulsion systems for conventional, supersonic, STOL and VTOL aircraft are reviewed. Component design and multimode operation of gas turbine propulsion systems are primarily considered. Renewed interest in nuclear power is noted, as well as application of supersonic-combustion ramjets for hypersonic aircraft.

Epstein, N.; Gordon, B. J.
PROFITABLE TRANSPORT ENGINES FOR THE ENVIRONMENT OF THE EIGHTIES.
SAE Prepr n 730347 for meet April 24-26 1973

This paper assesses the impact of meeting the environmental requirements for reduced noise and air pollution on the cost and technical design considerations for engines to power the next generation of commercial transport aircraft. Engine candidates studied are in the advances (new) design class as well as derivatives of existing high bypass turbofan engines which offer attractive total cost of ownership features. The elements of operating cost are analyzed for the effect of the engine on aircraft economics, with special attention to operating cost differences between new engines and those derived form current in-service high bypass engines.

Fitzsimmons, R. D.; Hoover, W. C.
AST - A FIFTH ENGINE FOR ENVIRONMENTAL CONSIDERATION
SAE Prepr Paper 730899 for meet Oct 16-17 1973

No greater contribution seems to exist for improving supersonic transport economics than by imporving the state of the art of jet noise suppressors. Exact matching of thrust requirements for supersonic cruise, transonic acceleration, climb, and expecially takeoff-climb is complex. The present design becomes an equivalent five-engine configuration, where the extra thrust is required to enable environmental levels of FAR part 36 to be achieved. The added size is required first to allow for engine throttling during takeoff run to provide reduced exhaust velocity and exhaust gas temperature consistent with suppressor structural limits, and secondly to make up for suppressor losses at takeoff flight speeds. As the engine selection must be closely tied to airplane selection, substantiation of the 2.2-M airplane selection is described.

Friedrich, R.; Barschdorff, D.; Hensle, W.; Wendtland, D.
UNTERSUCHUNGEN UEBER DEN ZUSAMMENHANG ZWISCHEN DER VERAENDERUNG DES GERAEUSCHSPEKTRUMS UND DEM BETRIEBSZUSTAND THERMISCHER STROEMUNGSMASCHINEN. (INTERRELATIONSHIP BETWEEN CHANGES IN NOISE SPECTRUM AND OPERATING CONDITION OF THERMAL TURBOMACHINERY).
MTZ Motortech Z v 35 n 3 March 1974, p 67-72

Experimental results of the effects of blade geometry and conditions on the specific characteristics in acoustic spectra are reported. The guidelines to monitor irregularities in blades (cracks or erosion) by analyzing the emitted sound spectrum are given. 7 refs. In German with English Abstract.

Technology Applications-

Foss, R. L.; Bragdon, E. L.
PROPULSION TECHNOLOGY ADVANCES NEEDED FOR A QUIET SUPERSONIC TRANSPORT.
SAE Prepr Paper n 730898 for meet Oct 16-18 1973

This paper examines the airport noise problems of large transport aircraft, highlights critical considerations, and then studies possible solutions available from advance propulsion tehcnology. Engine sizing requirements to meet SST payload-range and airport performance criteria are reviewed first, and the impact of noise on the engine size and aircraft performance is then identified. Relief offered by nosie suppressor development and technology advances that can be foreseen in the next decade for turbojet and turbofan engines are described. The advantages offered by a duct heating turbofan engine cycle are discussed. The potential offered by variable cycle engines to provide low noise characteristics with minimum penalty on performance are shown, and the practical restraints imposed on this potential by airframe aerodynamic noise is illustrated.

Griffith, E. D.; Roberts, G. F.
COMMERCIAL APPLICATIONS OF QUIET AIRCRAFT TECHNIOLOGY
SAE Paper 720339 for meeting March 15-17 1972

Recent experimental developments in military programs in aircraft quieting are reviewed in this paper, with suggestions on acoustic technology applications appropriate to general avaition. Comments are offered on the possible impact of developing noise abatement concerns, requirements, and legislation on general aviation. Potentially productive design tradeoff studies necessary to ensure minimum cost and an acceptable level of performance in the field of commercial light aircraft design are suggested. Reduction in the external acoustic noise signature of light piston-engine aircraft may logically be sought in the area of propulsion system design.

Montegani, F. J.
SILENCING THE BIG JETS WITH CURRENT TECHNOLOGY
SAE J Automot Engr v 81 n 2 Feb 1973 p 40-45

NASA's quiet engine program turns up some surprising results when it designs low-noise engines using techniques learned from the study of jet noise generation. One version promises a long-range transport almost 25 decibles quieter than today's operational aircraft.

Miscellaneous-

Anon
INTERAGENCY SUMPOSIUM ON UNIVERSITY RESEARCH IN TRANSPORTATION NOISE
2 vols. Stanford: Stanford Univ (1973)

Current university research in basic and applied noise problems related to transportation, and that is being carried out under the support of the various federal agencies, is reviewed in the proceedings. The topics discussed include jet noise, rotor noise, noise from moving bodies, the interaction of jets with solid surfaces, sound propagation through ducts, combustion noise, high intensity sound, selected problems, and the societal problems involved with noise generation

Devriese, J.; Young, P. H.
OLYMPUS IN CONCORDE.
Aeron J v 76 n 744 Dec 1972 p 683-694

Design concepts of the Concorde to improve efficiency and payload are reviewed, including: the basic engine, reheat system, secondary nozzle, protective and safety systems, operating features and maintenance. The use of an annular vaporizing chamber to reduce air pollution and design approach to solving noise pollution problems are discussed. 6 refs.

Hutchinson, J. E.
NOISE AND THE PILOT.
Shell Aviat News n 412 1972 p 19-21

Because of strong reservations concerning possible inherent dangers in the recommended noise abatement approach procedure, the International Federation of Airline Pilots Associations has agreed not to fly such a procedure. This article evaluates both the take-off and approach cases and concludes that alleviation of the noise nuisance cannot be achieved by any change in current well-established operational procedures. Engine technology and airport zoning are suggested as the more feasible treatments of the problem.

Piercy, J. E.
NOISE PROPAGATION IN THE OPEN ATMOSPHERE
Acoust Soc of Amer NY J, v 53 n 1 Jan 1973 p 291-392

Present understanding of outdoor noise propagation, and the way in which it may be brought to bear on current problems are reviewed, included are geometric spreading caused by source configuration, as well as absorption and refraction by the atmosphere. The fluctuations of sound level due to atmospheric conditions are also discussed. The importance of bringing into engineering use the knowledge obtianed in recent years in realted fields such as meteorology, propagation of light in the atmosphere, and vibrational relaxations in gases is emphasized.

Richards, E. J.
THE COST OF AIRCRAFT NOISE
Environ and Change, v 2 n 1 Sept 1973 p 53-59

Noise is a form of environmental nuisance inseparably linked with many industrial and social activities. Before accurate judgments can be made of the balance to be struck between development and amenity, the social cost of noise should be determined. There are now some procedures to determine the economic disbenefit caused by aircraft. Application of these procedures to the planning of airports is discussed.

Simcox, C. D.
JET NOISE SUPPRESSION SYSTEMS FOR HIGH-SPEED AIRCRAFT.
SAE Prepr paper n 730897 for meet Oct 16-18 1973

A goal of 20-EPNdB sidelines noise reduction for 2 percent static thrust penalty has been identified as a realistic possibility by the Boeing Commercial Airplane Company in a Department of Transportation SST technology follow-on program. Beoing analysis of an SST suggests that a dry turbojet or turbofan that is designed for takeoff, and can accept an equivalent retractable suppressor with 20 PNdB sideline supression for 2 percent static thrust loss, will allow sufficient growth without exceeding far part 36 minus 5 EPNdB in the next decade. 10 refs.

Stein, A.
REPORT ON AIRCRAFT NOISE POLLUTION
Rep on Aircraft Noise Pollut, Mar 24, 1971

The effects and control of noise are discussed, with emphasis on aircraft noise. Noise from piston-engined aircraft originates mainly in the exhaust and the propellers and is most intense at low frequencies of blade rotation. The three main noise sources in jet aircraft are turbulent mixing of jet exhaust with air, turbine blades, and compressor blades. Jet engine roar is greatest during take-off. Early methods of noise reduction involved fitting noise suppressors to exhaust; current attempts at cutting jet noise have concentrated on decreasing velocity while maintaining thrust by incerasing the mass of air flowing through the engine. Standards for aircraft noise measurement include dB, perceived noise in dB, and effective perceived noise. New York State laws and hearings concerned with noise are summarized along with regulatory practices of other states and countrys.

Toplis, A. F.
DHC-7: THE FIRST GOOD NEIGHBOR TRANSPORT AIRCRAFT.
Aircraft Engr v 45 n 6 June 1973 p 4-10, 12-13

The capabilities of the aircraft are cited, including meeting a noise target of 95 PNdB at 500 ft at a propeller tip speed of 715 FPS and low pollution emission levels to meet projected standards. Turboprop engines produce roughly half the particulate matter and 1/15th of the carbon monoxide of turbojet engines on take-off and landing. Specification are also given on the power plant, control systems, structural members, etc. 7 refs.

Williams, J. E.; Flowes
AIRCRAFT NOISE IN THE 1980's
Clean air Conf preprints. (held in Folkestone, Eng., Nov 2-5, 1971)
Natl Soc for Clean Air, Brighton, Sussex, Eng., 1971, p 104-113

Aircraft noise is a nuisance. Conservationists, government research establishments, universities and industry are working together to minimize the noise nuisance without ruining the economy of the air transportation industry. New aircraft can be made quieter, they may be assessed by means of a "noise foot-print" so called because of the foot-shaped pattern of the ground area exposed to noise in excess of a specified level during take-off and landing. Foot-print area is directly proportional to the number of people disturbed. Noise curbs for existing aircraft are being studied as well. Better engines and enforcement of noise regulations are helping to alleviate the problem. A low noise engine is described.

Williams, C. E.; Pearsons, K. S.; Hecker, M. H. L.
SPEECH INTELLIGIBILITY IN THE PRESENCE OF TIME-VARYING AIRCRAFT NOISE
J Acoust Soc Amer v 50 n 2 pt 1 Aug 1971 p 426-434

An experimental study is made to determine whether the relation between intelligibility test scores and the articulation index for steady-state noise can be used to predict speech intelligibility in the presence of time varying aircraft noise. The various noise measures tested were almost equally effective in such predictions. Appreciable disruption of contextual speech was noted when the peak level of a flyover exceeded 88 PNdB, a speech-interference level of 68 dB, or an a -weighted sound pressure level of 76 dB.

Yeowart, N. S.
NOISE DESIGN GOALS FOR THE NEXT GENERATION OF AIRCRAFT.
Acustica v 29 n 4 Oct 1973 p 225-227

Existing noise laws for aircraft will not help to fix noise design goals for the next generation of aircraft. A more realistic concept of "design for community acceptability" is introduced with examples of the resulting noise goals for STOL aircraft. The economic penalty of noise reduction attempts is contrasted with the benefits of increased useful land area for residential development. 3 refs.

Young, R. W.
EXAMPLES OF SAN DIEGO NOISE CLIMATE.
Inst Environ Sci, Proc 17th Annu Tech Meet, Living in Our Environ, Los Angeles, Calif, April 26-30 1971 p 385-392

Examples of San Diego noise climate are reported here in ways to allow comparison with presently proposed noise standards for California Airports. In July 1967, when there were 54 jet departures per day, the daytime average noise level, a half-mile west of the field, was 78 decibels; a mile east of the field the daytime average noise level for landings was 80 decibels. The maximum noise level at these locations during a flyover was typically 110 decibels. In 1967, the "noise impact area" west of Lindbergh field, bounded by the 70-decibel contour of community noise equivalent level, was a mile wide and four miles long.

BUILDING NOISE

Damping and Insulation Materials

Wood Framed Buildings -

Grantham, J. B.; Heebink, T. B.
INSURING NOISE CONTROL IN WOOD-FRAMED BUILDINGS
For Prod, J, v 22 n 5, May 1972, p 36-43

The paper describes a number of faulty construction practices that can lead to reduction of expected sound insulating properties and illustrates proper methods derived from field test experience. It is shown that losses due to flanking may reduce the sound transmission class (STC) of a wall by 10 points, but the combination of leaks and flanking generally reduces the STC by only one to five points.

Heebink, T. B.; Grantham, J. B.
PREDICTED VS. ACTUAL SOUND INSULATION OF WOOD FRAMED PARTY WALLS AND FLOOR-CEILING ASSEMBLIES
Noise and Vibr Control Engr Conf, Proc, (Layatette Inc, July 14-16, 1971)

Acoustical data from laboratory tests are compared with field measurements in apartment in the Seattle area. Thirty-one field evaluations of the sound attenuation provided by wood framed party walls and floors show remarkable agreement with published laboratory ratings. On the average, the party walls were three points below and the floor-ceiling assemblies were one point below the STC values obtained in laboratory tests.

Plasterboard Panels -

Mulholland, K. A.
SOUND INSULATION MEASUREMENTS ON A SERIES OF DOUBLE PLASTERBOARD PANELS WITH VARIOUS INFILLS
Appl Acoust, v 4 n 1, Jan 1971, p 1-12

A series of measurements are reported of the sound transmission loss of double layered plasterboard panels. Measurements were carried out with the panels separated by 50, 100, and 150 mm. Between the panels was placed a layer of either polyurethane, polystyrene, or rockwool, and measurements were also made with no sound absorbing infill for comparison purposes. The results of these measurements are presented together with comments on the implications of the results. 13 refs.

Brick and Masonry -

Hudson, R. R.; Mulholland, K. A.
MEASUREMENT OF HIGH TRANSMISSION LOSS (THE BRICK WALL EXPERIMENT)
Acustica, v 24 n 5, May 1971, p 251-261

A laboratory method of measuring the sound insulation of a high insulation wall is described and some results of measurements carried out on a double brick wall mounted in an ordinary transmission suite are reported. 17 refs.

Shippee, Edgar G.
MATERIALS FOR NOISE ABSORPTION
Pollut Engr, v 5 n 1, Jan 1973, p 37-38

It is shown how an economical, effective wall can be constructed using proprietary sound-absorbing structural masonry blocks. These building blocks have closed-top cavities which act as damped resonators. Structural data on noise absorption for suspended ceiling materials and suspended unit absorbers.

Materials -

Ellwood, E. E.
NOISE CONTROL EFFECTS OF ROCK WOOL
Pollut Engr, v 5 n 8, Aug 1973, p 27

The results of a continuing study of wool and its effects on acoustical transmission loss. The data presented shows the definite relationship between sound transmission class and the weight of wood in the stud cavity, lb/sq ft.

Jones, D.I.G.
DAMPING TREATMENTS FOR NOISE AND VIBRATION CONTROL
Sound and Vibr, Cleveland, v 6 n 7, July 1972, p 25-31

A survey is made of the techniques and materials which can be utilized for the control of noise transmission and vibration induced failure in structures. Consideration is given to dynamic behavior of damping materials as a function of temperature and the effect of various damping treatments on the response and modal damping of a variety of structures exhibiting many different stiffness and geometrical characteristics. Examples are given of prior applications of damping to the solution of a variety of vibration and noise control problems, and of materials available for vibration control.

Inlefeldt, J.; Kock, P; Tappe W.
BONDAL - EIN WERKSTOFF ZUR LAERMBEKAEMPFUNG - AUFBAU, AKUSTISCHES VERHALTEN, VERARBEITUNG, ANDWENDUNGEN (BONDAL - A NOISE-ABATEMENT MATERIAL)
Hoesch, Ber Forsch Entwickl Werke, v 8 n 3, 1973, p 99-108

The application data for a new composite material with high damping sound factor is outlined. Experimental results with layers of different thicknesses of this material lined on sheets are given. Several examples are illustrated of its application on motor hoods and doors. 22 refs in German.

Nesterenko, D. A.; Pugh, R. G.
RUBBER ISOLATORS CONTROL NOISE
Pollut Engr, v 3 n 6, Nov-Dec 1971, p 29-31

Installation of machines in buildings and on floors above the ground is a special consideration of design. However, too often little attention is given to the problem because of small equipment size and minor unbalanced forces. While some types of equipment can be located directly on the floor in noncritical locations, other types will require isolators if acceptable vibration and noise control is to be attained.

Windows

Ford, R. D.; Kerry, G.
THE SOUND INSULATION OF PARTIALLY OPEN DOUBLE GLAZING
Appl Acoust, v 6 n 1, Jan 1973, p 57-72

The Sound Reduction Index (SRI) was measured in the laboratory for partially open sliding window units to test the feasibility of achieving moderate degree of sound insulation while retaining natural ventialtion. With source spectra assumed for aircraft and traffic noise and with the measured SRI's the sound level difference across a window was calculated in terms of dBA. Partially open double glazing was about 10 dBA better than partially open single glazing, and double glazing could be opened as much as 100 mm and still be as effective against aircraft noise as closed single glazing.

Hottinger, R.
DIE SCHALLISOLATION VON FENSTERN (WINDOWS AS NOISE INSULATORS)
Schweiz Bauztg, v 91 n 36, Sept 6, 1973, p 861-865

Design methods for windows that should serve not only as insulators for heat and extreme cold and other weather elements, but also as soundproof barriers are discussed. Drawings and graphs of various windows are presented. 6 refs in German,

Oostings, W. A.
THE SOUND INSULATION OF SINGLE AND DOUBLE GLAZINGS WITH RESPECT TO TRAFFIC NOISE
Noise 2000, Assoc Intl Contre le Bruit, Intl Cong, 5th & 6th, (London, May 1968 and Groningen, Netherlands, 1970)

The noise levels of road traffic fluctuate, but the spectra of the peak noises are nearly the same in the majoritiy of paractical cases. This gives the opportinity to make a good and simple comparison of the insulation qualities of various types of single and double windows against traffic noise, if the insulation properties of these glazings in the various frequency bands are known. A method is described that gives the difference between inside and outside noise levels, as obtained with these glasings, directly in dBA.

Patil, Pandit, G.
CONSTRUCTION OF MULTI-GLAZED GLASS PRODUCTS FOR NOISE REDUCTION
Pollut Engr, v 5 n 4, May 1973, p 40-41

A double-wall partition is defined as a partition in which points on opposite sides of the structure do not necessarily move the same way at the same time. The theoretical transmission loss of a double-wall partition of infinite area at any angle of incidence is given by the equation (for identical panels).

Patil, P. G.
DESIGNING GLASS UNITS FOR SOUND REDUCTION
Sound and Vibr, v 7 n 9, Sept 1973, p 38-39

Laminated and double-glazed glass units provide improved acoustical performance over monolithic units. Basic guidelines for designing glass units with predictable acoustical ratings are presented. Information is provided on acoustical properties of a room and practical applications of glass as a sound barrier material.

Paulsen, Einar
PERFORMANCE REQUIREMENTS FOR WINDOWS
Natl Bur Stand, Spec Publ, v 1 n 361, 1972, p 375-384

Statements of performance requirements are given under the following headings: Transparency and Vision, Light Transmission, Glare, Control of Solar Radiation, Thermal Insulation and Condensation, Sound Insulation, Airing (ventilation), Air-Tightness, Rain-Tightness, Strength and Stiffness, Control of Opening Light, Security Against Illegal Engry, Fire Resistance, Escape from Fire, Appearance, Dimensions, Durability of Operating Parts, and Durability of Materials. 6 refs.

Smith, H. C.
ACOUSTICALLY RATED WINDOWS
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, Jul7 14-16, 1971)

Technology necessary to result in marketable, efficient sound-attenuating windows of lasting quality is explained. Design, materials fabrication, and testing of such windows are described. Factory-glazed and hermetically-sealed, sound-attentuating windows are now available commercially at reasonable costs within wide ranges of sound transmission classes.

Yerges, L. F.
WINDOWS, THE WEAK LINK
SIV, Sound Vibr, v 5 n 6, June 1971, p 19-21

Windows, particularly operable or movable sash, in the exterior walls of buildings in the vicinity of airports have proved to be major sound "leaks". A simple means of forecasing the noise exposure, determining the required insulation of the window systems and choosing adequate materials and construction details is outlined.

Office Noise -

Routson, H.
CONTROL OF OFFICE NOISE
Pollut Engr, v 5 n 6, June 1973, p 36-37

The international organization for standardization has guidelines establishing office noise levels of 20-70 dB. Methods of monitoring noise in offices and ways to reduce office noise are discussed.

Laboratory Noise -

Zouboff, V.
L'ISOLATION PHONIQUE DANS LES LABORATOIRES (SOUND INSULATION IN LABS)
Lab Cent Ponts Chaussees, Bull Liaison Lab Ponts Chaussees, v 58, Mar-Apr 1972, p 109-115

The article relates a specific case of sound insulation in the Blois Regional Laboratory. The physics of noise and acoustic control apparatus are described. Review of the principles of the methods of combating airborne and impact noises. An example of insulation against shock noises using the "floaing slab" principle.

Acoustical Flanking -

Price, A. J.; Wakefield, C. W.; Rackl, R.
THE MEASUREMENT OF ACOUSTICAL FLANKING IN BUILDINGS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, Oct 4-6, 1972, Wash DC

A cross correlation technique for measuring the characteristics and importance of acoustical flanking paths between two rooms separated by a partition is described. A pair of model rooms constructed of 1 in. plywood were used. The dividing partition was sealed and made of 1/8-in. thick al, and both rooms were lined with 2 in. thick fiberglass. A trumpet driver was used as the sound source. Measured normal incidence transmission of loss of the partition agreed with the normal incidence mass law, indicating a small amount of acoustical flanking, if any.

Shiner, A. H.
ACOUSTICAL FLANKING IN STRUCTURES
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

Test results of sound energy transmission of flanking paths in two-story wood-frame buildings are presented. Partitions and floor-ceiling systems with known transmission characteristics were installed in the test structure and the combined transmissivity determined. Differences between the total transmission and the transmission of the dividing elements were ascribed to flanking. The sound transmission class (STC) of the structure (flanking energy) rather than the STC of the dividing elements was the dominant feature in determining room-to-room reduction.

Corridors, Large Halls and Partitions -

Davies, H. G.
NOISE PROPAGATION IN CORRIDORS
J Acoust Soc Amer, v 53 n 5, May 1973, p 1253-1262

A geometrical-acoustic analysis is made of some aspects of high-frequency noise propagation along a corridor and into the adjoining rooms from a given noise source in the corridor. Attention is given to means of absorbing sound at the corridor walls. Expressions are given for the attenuation for several cases when one or more walls have either high- or low-absorption coefficients for the transmission of sound through open doorways and for noise propagation at corridor junctions and corners. Experimental results are included.

Tocci, G. C.; Davies, H. G.
NOISE PROPAGATION CORRIDORS
Acoust Soc of Amer, NY, J, v 52 n 1, July 1972, p 112-188

As an effort to reduce noise propagation in corridors, a study was undertaken to evaluate the use of absorbing and shielding baffles in corridors. Both noise attenuation in the corridor itself and also the reduction of noise propagating through open doors into rooms adjacent to the corridor were considered. A discussion is presented of the effectiveness of both the shielding and the absorbing components of the noise reduction for baffles oriented parallel to and perpendicular to the corridor direction. Predictions based on approximate modal summations for the power flow in the corridor are compared with experimental results.

Tatusesco D; Panaitesco, A.
L'IMPORTANCE ET LES CONSEQUENCES ARCHITECTURALES DE L'INSONORISATION DES GRANDES SALLES DANS LES BATIMENTS SOCIAUX ET CULTURELS (ARCHITECTURAL IMPORTANCE AND CONSEQUENCES OF THE ACOUSTICS OF LARGE HALLS IN BUILDINGS FOR SOCIAL AND CULTURAL PURPOSES)
Appl Acoust, v 4 n 1, Jan 1971, p 13-21

As long as acousticians are alone in emphasizing the importance of acoustic studies at the design stage the chances of progress remain rare. An effort must be made to convince architects that acoustic processing, far from limiting the possibilities of creative expression, succeeds on the contrary in enhancing the architectural achievements. The use of well conceived lighting may also result in an important contribution in this respect. In order to illustrate the variety of aesthetic possibilities offered by acoustic processing, the hall in an office building has been taken as an example. In French.

Tseo, G. G.
ESTIMATING THE NOISE REDUCTION OF WALL STRUCTURES OF ENCLOSURES
J Acoust Soc Amer, v 52 n 6, Part 1, Dec 1972, P 1573-1578

A simple technique based on plane-wave normal incidence is used to calculate the coefficients for transmission. Reflections and absorption of a wall structure. Several structures having combinations of impervious layers air space, and sound-absorbing materials are evaluated and used as examples to show the effect of mass, acoustical impedance, propagation constant and materials arrangement on the wall acoustical performance.

Ver, I. L.
RECENT DEVELOPMENT IN PREDICTION OF SOUND TRANSMISSION LOSS OF SINGLE PARTITIONS
Noise and Vibr Control Engr Conf, Proc (Lafayette Ind, July 14-16, 1971)

Recent developments in the prediction of sound transmission loss of single partitions are reviewed. The infinite, homogeneous, isotropic partition will serve to introduce the physical parameters (mass per unit area, coincidence frequency, and loss factor) which determine the sound transmission.

The investigation of finite-size partitions requires the introduction of new variables such as the radiation efficiency and the composite loss factor which take into account the boundary conditions. The effect of these new variables is explained by comparing the sound transmission loss of finite and infinite partitions. The effect of add damping, mass and stiffness and of the anisotropy on the sound transmission are also discussed

Coupled Rooms -

Jones, R. E.
AIRBORNE NOISE CONTROL FOR VERTICALLY STACKED BATHROOMS WITH MECHANICAL EXHAUST SYSTEMS
U.S. Forest Prod Lab, Res Note FPL-0222, 1972

It is shown how sound insulation properties of an otherwise satisfactory wall or floor can often be nullified when a noise flanks (bypasses) this surface. This applies to wood frame, and is especially important in multi-family houses. An example of flanking is described for vertically stacked bathrooms where the sound travels from one bath to the other through the ventilation ductwork. Two types of ductwork connections are given.

Koopmann, G.; Pollard, H.
MODEL STUDIES OF HELMHOLTZ RESONANCES IN ROOMS WITH WINDOWS AND DOORWAYS
J Sound Vibr, v 16 n 4, June 22, 1971, p 489-503

To determine the conditions and possible damaging consequences of the cavity resonance of a room enclosed by large windows and open doors subjected to an impulsive load a study has been conducted which utilizes the method of expressing the windows, air and common doorway to two typically joined rooms in terms of equivalent lumped elements. The resultant dynamic system is treated as a series of coupled Helmholtz resonators and has as its mathematical description a set of coupled, second-order differential equations. 9 refs.

Molodaya, N. T.; Nikonov, A. V.; Rysin, Yu, S.
STUDY OF ACOUSTIC NOISE IN TOLL CENTER SWITCHING ROOMS
Telecommun Radio Engr, v 26-27 n 11, Nov 1972, p 40-42

The spectrum of acoustic noise in toll center (TC) switching rooms is analyzed. Acoustic noise level distribution functions, obtained from round-the-clock measurements are given. Curves indicate the dependence of noise level on the number of working operators and on the reverberation time of the room. 6 refs.

Mugglin, E.G.A.
LAERMBEKAEMPFUNG AUS DER SICHT DES BAUUNTERNEHMERS
Noise 2000, Assoc Intl Contre le Bruit, Intl Congr, 5th & 6th (London, May 1968 and Groningen, Netherlands, 1970)

Ideally a building method considers requirements of the building site and those of a neighbor, economics, and noise production. It is a question of developing building methods low in noise and of carrying them out with low noise machines. Excessive building noise is only acceptable if no other method of building is available or if a lower noise method would mean enormous extra costs. One example of a low noise building method is the cavity wall method, which can be used instead of ramming iron bulkheads.

Nilsson, A. C.
REDUCTION INDES AND BOUNDARY CONDITIONS FOR A WALL BETWEEN TWO RECTANGULAR ROOMS - THEORETICAL RESULTS
Acustica, v 26 n 1, Jan 1972, p 1-23

It is shown that exact solutions can be derived for the sound pressure levels in two adjacent rooms when the geometry is that of the given configuration, energy losses and flanking transmission can be neglected at the edges; and, the walls are acoustically hard. The reduction index is measured for a concrete wall between two rectangular rooms with equal dimensions. The absorptions in the rooms are varied and the measurements are made with and without diffusors. It is found that the reduction index depends on the absorptions in both rooms and on the character of the fields. The measurements show the error caused in the reduction index when the absorption in the source room is neglected and when there are no diffusors in the rooms. 13 refs.

Shuku, T.; Ishihra, K.
THE ANALYSIS OF THE ACOUSTIC FIELD IN IRREGULARLY SHAPED ROOMS BY THE FINITE ELEMENT METHOD
J of Sound and Vibr, v 29 n 1, July 8, 1973

The problem of noise in the passenger compartment of an automobile is that of an acoustic field in a room with a complex shape. While the theoretical solution of the normal frequencies and modes of such an irregularly shaped room is difficult, it was attempted by perturbation methods and finite difference methods. The finite element method is applicable with good accuracy to rooms of arbitrary shape. It can be conveniently applied for routine calculations. The triangular finite element has a good applicability to two-dimensional irregular shapes. Good accuracy can be obtained for shapes with large distortions or complex geometries by using a automobile-compart-models shown good agreement in normal frequencies and modes. The results are compared with those obtained when linear shape functions or finite difference methods are used.

Vaidya, P. G.; St. Hilaire, A.
BUILD UP OF SOUND FIELDS IN ISOLATED AND COUPLED ROOMS
Noise and Vibr Control Engr Conf, Proc, (Lafayette Inc, July 14-16, 1971)

Relevant features of the theory of acoustic buildup of sound in rooms are reviewed and examples aimed at exploring the relevant parameters which affect the build up of sound are presented. An outline of a theory is presented which deals with the response in a smaller room due to sources in a larger room (which, in the limit, could also be open space) sending signals into the smaller room through an opening connecting the two rooms. Two different models are proposed for the theoretical prediction. A comparison between theory and experiment is made. Some generalizations of practical interest are speculated, and, if proven, these would help simplify the analysis of sound fields in complex configurations.

Walls

Anon
LIVE-IN WALL, 3,999 FT LONG, IS ALSO A SOUND SHIELD
Engr News-Rec, v 191 n 10, Sept 6, 1973, p 23

A 3900 ft long, 18 ft wide wall under way in England will serve as both shelter and sound shield. The wall/shelter, to contain 387 apartments housing 800 persons, will provide a barrier to block noise generated by traffic on a planned six-lane expressway.

Ellwood, E.
ANATOMY OF A WALL
AIV, Sound Vibr, v 6 n 6, June 1972, p 14-18

The laboratory STC rating for a panel is usually a very accurate value, based upon careful measuring techniques and carefully controlled test conditions. The dependence upon such a value, however, may lead the unsophisticated designer or builder into a lot of trouble when the panel is incorporated into a building. Most buildings are a collection of systems, each element of which contribures to the overall performance of the structure. The effect of apparently trivial details such as the selection of an acoustical sealant and its application at the runner tracks and ceiling abutments is outlined in this study.

Engles, H.
WAERME-UND SCHALLSCHULTZ VON INNENWAENDED (THERMAL AND SOUND INSULATION OF INSIDE WALLS)
Ind-Anz, v 94 n 86, Oct 17, 1972, p 2045-2048

Several examples are presented which illustrate different designs of inside walls and partitions with efficient thermal and sound insulation. Particular attention is given to the application of insulating mineral wool slabs and felts for this purpose. 2 refs. In German.

Mull, H. R.
ESTIMATING NOISE EXPOSURE FOR SITE SELECTION AND EXTERIOR WALL DESIGN
J Audio Engr Soc, v 21 n 9, Nov 1973, p 726-728

Accurate knowledge of the ambient noise levels exterior to a theater, concert hall, or studio is required for site location and wall design. Measured noise levels over a long enough time to be statistically significant are too costly if a number of sites are being considered. Methods of estimating the noise exposure with sufficient accuracy for preliminary evaluation are presented.

Profit, J.
COMPOSITES FOR NOISE CONTROL - SOUND-DEADENED STEEL (SDS)
Sheet Mft Inc, v 51 n 1, Jan 1974, p 44-50

Sandwiching a thermoplastic layer between two sheets of steel produces a panel with high mass and vibration damping properties for sound insulation. This article outlines the properties of these laminates by comparing a range of development products, currently known as SDS, with the properties of conventional steel sheet. The vibration damping characteristics are discussed, together with the engineering properties and recommended methods of fabrication, where these differ from ordinary steel.

Sharp, B. H.
NEW WALL DESIGNS FOR HIGH TRANSMISSION LOSS
Noise and Vibr Control Engr Conf, Proc (Layfayette Ind, July 14-16, 1971)

Many wall constructions in common use today involve two panels separated by a support mechanism. The acoustical behavior of these constructions is determined by the familiar double wall characteristics, which in theory are capable of providing extremely high values of transmission loss. In practice these high values are not usually obtained due to the presence of necessary support members which often form a direct mechanical connection between the two panels of the wall. The effects of cavity absorption and sound bridges on the transmission loss are investigated. A new wall design is described which features modified staggered stud construction and achieves significantly improved STC ratings.

Venzke, G,; Daemmig, P.; Fischer, H. W.
DER EINFLUSS VON VERSTEIFUNGEN AUF DIE SCHALLABSTRAHLUNG UND SCHALLDAEMMUNG VON METALLWAENDEN (INFLUENCE OF STIFFENERS ON THE SOUND RADIATION AND THE TRANSMISSION LOSS OF METAL WALLS)
Acoustica, v 29 n 1, July 1973, p 29-40

Sound transmission loss and the radiation factor were measured on walls consisting of aluminum. 4 mm thick, covering an area of 9.2 m^2. They were installed between two reverberant chambers. One of the walls was not stiffened, the second had been stiffened by parallel ribs and the third by cross-connected ribs. All measurements as stated above were repeated after covering the three walls with a damping layer. Excitation of the walls with airborne sound as well as point excitation was investigated. Below the critical frequency, the resulting differences in transmission loss of the three walls amount up to 9 dB. They reduce to 4 dB when the walls are covered with the damping layer. Hence, with damping the transmission loss of the stiffened walls increases more than that of the unstiffened one. Below the critical frequency, the differences in transmission loss are due to radiation as well as excitation qualities. Radiation with point excitation depends very little on damping, but considerably on the extent to which the walls are stiffened. 9 Refs. In German with English abstract.

Willigers, L.H.J.; Van Den Eijk, J.
SATISFACTORY SOUND INSULATION BETWEEN DWELLINGS: A REAL POSSIBILITY
Noise 2000, Assoc Intl Contre le Bruit, Intl Congr, 5th & 6th, (London, May 1968 and Groningen, Netherlands, May 1970)

For satisfactory airborne sound insulation between dwellings, more insulation than the usual minimum requirement in western Europe is necessary. This goal is attainable if thick external walls and floors are combined with lightweight internal walls. Improved insulation values of 6-9 dB were measured in apartments of a building system for social housing.

Ceilings

Burke, J. J.
LIGHTING SOUND CONTROL - A SPECIFIER'S PRIMER
Actual Specif Engr, v 30 n 5, Nov 1973, p 94-98

The author gives a detailed account of how to control the noise level generated by lighting fixtures and offers an introduction to acoustical concepts.

Grantham, J. B.
AIRBORNE-NOISE CONTROL IN LIGHTWEIGHT FLOOR/CEILING SYSTEMS
SIV, Sound Vibr, v 5 n 6, June 1971, p 12-16

A variety of light weight floor/ceiling systems are used in wood-frame suburban apartments of the Pacific Northwest to control noise transmission. Field measurements of airborne-sound insulation provided by floor/ceiling constructions in six Seattle buildings demonstrate the effectiveness of cellular concrete and resilient channels in limiting noise transmission.

Izenour, G. C.
DESIGNING AND ENGINEERING COMPUTER CONTROLLED ACOUSTIC FLEXIBILITY FOR A MULTIPLE-USE THEATER
Archit Rec 3, Mar 1974, p 143-148

Acoustical flexibility, in addition to the volumetric control provided by the movable ceiling, is achieved by a system of 37 individual motor-operated absorption drives between the woven steel trans-sondent mesh and hard plaster reflecting convex splayed side and rear auditorium walls. Designing, fabricating, erecting and rigging the acoustical system is described.

Kessler, F. M,
EVALUATION OF NOISE CONTROL FOR THE WORKD TRADE CENTER PATH TERMINAL
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 591-392

Track vibration isolation in the form of tie-in-pocket construction, a highly acoustical absorbent metal pan ceiling construction, and other noise control features were used at the newly built World Trade Center Path Terminal. Noise measurements were made at numerous positions at the Church Street Path Terminal prior to its discontinuance as a terminal and at the World Trade Center Path Terminal just after its completion. An improvement was indicated in passenger comfort due to the reduction in platform and concourse noise levels. These data were analyzed and compared as to noise criteria, statistical a-weighted noise level, and statistical octave-band spectra. A noise level criterion of $L_{10}75$ dBA for passengers waiting at the platform was developed and compared with noise levels measured at the two terminals and at a typical midtown street location. Testing of the track lubrication system was also accomplished.

Lowe, A. W.
THE EFFECTIVENESS OF BARRIERS UNDER EXTENDED CEILINGS
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Oct 4-6, 1972, Wash DC

A 440 ft x 540 ft x 38 ft high factory floor was used. The sound source consisted of chipping operation noise at a level of 117 dBA at 3 ft. The data obtained consisted of the direct, refracted, and reflected components of the noise in addition to the total sum. The reported results are in dBA. As a design aid various combinations of wall and floor ceiling absorption coefficients were run. Under extended ceilings, sound propagates with noticably less reduction with distance than predicted by spherical spreading loss. This is caused by buildup of reflections from the floor. At great distances the buildup can be as much as 11 dB above the spherical spreading prediction. With the presence of walls there is an additional buildup of reflections which can add another decible or two at great distances. In the cases where it is desired to use a partial barrier to reduce the noise in selected areas, the reflections from the walls and ceiling reduce or eliminate the shadowing effect at great distances. The shadowing obtained by barriers appears nearly independent of size except in the region close to the barrier. The addition of absorbent ceilings and walls greatly increases the shadowing. Wall and ceiling reflections completely eliminate any advantage to use of multiple barriers. Partial enclosures benefit more from the use of absorbent room ceilings than from roofs on the enclosure.

Thomas, L, B.
FUNCTIONAL PROPERTIES OF SUSPENDED CEILINGS
Insulation (London), v 16 n 5, July-Aug 1972, p 179-182

Aspects of suspended ceilings such as fire resistance, thermal insulation and acoustics are dealt with. Fire resistance and surface spread of flame, thermal insulation and problems associated with sound absorption are discussed.

Floors

De Clerck, W.
DE INVLOED VAN DE BOUWWIJZE OP DE LANGSGELEIDING VAN HET GELUID DOOR DE DRAGENDE KONSTRUKTIE (EFFECT OF THE CONSTRUCTION METHOD ON THE LONGITUDINAL SOUND TRANSMISSION ALONG THE SUPPORTING STRUCTURE)
Ingenieursblad, v 41 n 7, Apr 1, 1972, p 209-213

The effect of the construction method on sound propagation in floors is dealt with. It is shown that a high level of sound transmission through floors may result from two causes: either a floor having a very low weight-to-area ratio, or a carelessly and unsatisfactorily built structure. 5 refs. In Dutch.

Ford, R. D.; Warnock, A.C.C.
IMPACT NOISE ON FLOORS
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188, N.Y.

A study was made of impulses created by an instrumented standard tapping machine hammer when it strikes various resilient coverings placed on a concrete floor to test the premise that the improvement obtained by using the resilient covering is additive to the basic nature of the floor. In spite of some discrepancies, more marked with carpets than with vinyl, to a close approximation this turned out to be the case. The second part of this study was subjective and was a preliminary attempt to define the parameters of footstep noise upon which subjects base their evaluation. Recordings of footsteps were made in a reverberant room both in its usual conditions with a reverberation time of 2 to 4 sec and with absorbent material added to reduce the reverberation time to about 0.5 sec, which is more typical of domestic conditions. Subjects were asked to adjust the level of a masking noise until the footsteps were no longer intrusive. A better correlation was found with peak levels of sound than the long-term RMS levels. This suggests that the usual method of normalizing for room absorption may be inappropriate for impact noise problems.

Josse, R.
HOW TO ASSESS THE SOUND-REDUCING PROPERTIES OF FLOORS TO IMPACT NOISE (FOOTSTEPS)
Appl Acoust, v 5 n 1, Jan 1972, p 15-20

After reviewing recent studies where it is assumed that noise resulting from the footsteps of adults, mainly women wearing high-heeled shoes, is the determinant criteria for classifying the impact-sound transmission of a floor. The author discusses the principal studies on the subject and the modifications proposed for an improvement of the ISO method. 21 refs.

Mahig, J.; Elliott, H. J., Jr.; Gentile, R. J.
NOISE AND VIBRATION TRANSMISSION FLOORS AND WALLS
Florida, Univ, Gainesville, Engr and Ind Experiment Station, Engr Progress at the Univ of Fla, v 28 n 1, July 1972, p 18-20

An experiment determined the noise and vibration levels caused by pumps and motors in a building, and definite frequency band pass region existed for a concrete slab. The vibrations of the floor slab decayed rapidly to 10 percent of its amplitude at the source and only slightly thereafter at frequencies above 100 Hz, and the noise level in the room could be significantly affected by force input into the floor slab. The wall was not affected transversely by floor vibrations of the amplitude considered, and significant transmission losses would occur if the slab were not continuous at the wall and if the wall did not have substantial contact with the joints.

Nute, M. E.; Slater, K.
STUDY OF SOME FACTORS AFFECTING SOUND REDUCTION BY CARPETING
J Text Inst, v 64 n 11, Nov 1970, p 645-651

An account is given of an investigation of the dependence of sound-transmission loss on carpet-pile parameters in a laboratory sound tube over a broad range of frequencies. From these tests, it appears that the pile thickness and weight have only a minor influence on sound-transmission loss and that the pile density has virtually no effect. It is postulated that other factors, which would affect the total permeability of the material, may be more important. It is also shown that the percentage of sound absorbed within a chamber is proportional to the size of the sample used. 16 refs.

Ver, I. L.
IMPACT NOISE ISOLATION OF COMPOSITE FLOORS
Acoust Soc of Amer, J, v 50 n 4, Oct 1971, P 1043-1050

A procedure for calculating the impact-noise level of a bare stiff structure floor when excited with a standard tapping machine is described. Calculations are given for the improvement in impact noise isolation achieved by adding to the structural floor an elastic surface layer, a locally reacting floating floor, and resonantly reacting floating floor.

Ver, I. L.
RELATION BETWEEN THE NORMALIZED IMPACT SOUND LEVEL AND SOUND TRANSMISSION LOSS
J Acoust Soc Amer, v 50 n 6, Part 1, Dec 1971, p 1414-1417

An expression is derived relating the normalized impact sound level and the sound transmission loss of a floor, accounting for both its resonant and its forced response. An evaluation is made of a floating floor assembly in a resilient mount.

Standards and Criteria

Baade, P. K.
HOUSEHOLD NOISE PROBLEMS
J Acoust Soc Amer, v 50 n 5, Part 1, Nov 1971, p 1233-1235

Communication to the editor makes a plea for uniform sound ratings on household equipment. For information on proper application and installation and for realistic criteria on acceptable sound levels. Recent standards are cited for the air conditioning and refrigeration institute. Data are given for noise of a refreigerator, air conditioner and dishwasher in a typical kitchen.

Baldwin, B.
SELECTION GUIDELINES FOR MOVABLE OFFICE PARTITIONS
Plant Engr (Barrington, Ill), v 27 n 15, July 26, 1973, p 58-62

Three types of partitions: demountable, semiportable and portable are utilized to rearrange office areas without the cost and inconvenience of remodeling. A description of each partition type, installation time, cost per sq ft, sound attenuation rating and fire resistance are included as a guideline to selection.

Braun, H. H.; Glueck, K.
DIE LAERMKARTE IN DER STAEDTEBAULICHEN BESTANDSAUFNAHME

The noise situation is of great interest in preparatory town planning. The noise map is especially suitable for the application in the planning process because of its clearness and the possibility to combine it with other maps in town planning. General applications and criteria for preparation of noise maps are discussed.

Dobson, D. E.
PERFORMANCE CONCEPT IN THE SERVICE OF TECHNICAL EVALUATIONS OF BUILDING INNOVATIONS
Natl Bur Stand, Spec Publ, v 1 n 361, 1972, p 491-502

The increasing effort of the National Building Research Institute (NBRI) in the field of technical evaluation and performance requirements is surveyed. Terminology is defined and selected aspects of performance discussed. The performance concept is assessed in terms of its cardinal position in the evaluation of innovations in building, limitations of the concept and the continuing need for the exercise of evaluation judgement. 7 refs.

Fuchs, G. L; de Romera, A.M.V.; Biassoni, E. C.
WHAT CONSTITUTES AN ACCEPTALE NOISE ENVIRONMENT IN BUILDINGS? CAN IT BE MEASURED?
Acoust Soc Amer, J, v 52 n 5, Nov 1972, p 1309-1317, Menasha, Wisc

Subjective tests were conducted on what makes noise unacceptable for different kinds of activities and architectural spaces. Present standards of measurement and criteria might not indicate adequately the actual noise intrusion of domestic noises. A method for checking acceptable noise ambients is suggested, which would facilitate acoustical control in present day construction.

Hardy, A. C.; Lewis, P. T.
SOUND INSULATION STANDARDS FOR BUILDINGS ADJACENT TO URBAN MOTORWAYS
J Sound Vib, v 15 n 1, Mar 8, 1971, p 53-59

An investigation into the noise from urban motorways was carried out in three stages. The first was a study of the amplitude and frequency distribution of traffic noise; the second was to study the attenuation of traffic noise by the building; and the third was to study the effect of the transmitted noise on the internal environment. Data obtained is sufficient to make possible the design of new buildings adjacent to urban motorways to achieve a satisfactory standard of noise insulation.

Hay, B.
EFFECT OF EXTERNAL NOISE ON THE PROVISION OF BUILDING SERVICES FOR LANDSCAPED OFFICES
Build Serv Engr, v 40, Jan 1973, p 227-231

Review of literature on the effect of external noise on the provision of building services that should be considered at the feasibility stage of building design. 18 refs.

Kodaras, M. J.
SIMPLIFIED ACOUSTICAL MEASUREMENT PROCEDURES FOR BUILDING CODE ENFORCEMENT
Natl Bur Stand, Spec Publ, v 1 n 361, 1972, p 447-481

EW and revised building codes now contain specific requirements for acoustical privacy in multifamity dwellings. These performance specifications for sound transmission loss, impact sound insulation, maximum permissible sound power radiated by mechanical equipment and isolation of structural vibration sources must be subject to field measurements to assure compliance with the building code provision. This paper reviews some of the simplified field test procedures now in use and in process of development. 5 refs.

Kodaras, M. J.
WRITING NOISE CONTROL INTO A MODERN BUILDING CODE
Actual Spec Engr, v 30 n 4, Oct 1973, p 107-109

The author's firm was assigned to the task of preparing noise control data for the New York City building code. He describes the code, its preparation, implementation and how it's being accepted.

Schultz, T. J.
HOW NOISE CREEPS PAST THE BUILDING CODES
Noise Control Engr, v 1 n 1, Summer 1973, p 4-15

Noise control requirements in building codes have little chance of success unless the primary objective for privacy is stated in terms of a performance specification. Compliance must be demonstrated by tests of adequate isolation in the completed building. It combines the advantages of existing codes and the (so far untried) requirements in terms of performance specifications. The ultimate acceptance for occupancy of all housing should depend upon a specified amount of isolation between dwellings and a specified range of background noise being achieved in the finished building. The proposed procedure for evaluating acoustic isolation requires three steps: a screening test for isolation is performed; if a deficiency in noise reduction appears, the first test will be repeated under the supervision of an acoustical engineer; and if the building fails the second test, the defective part of the structure must be determined and corrected. The pitfalls of approaches that presently measure noise in buildings are discussed.

Turner, N.
ACOUSTIC PERFORMANCE STANDARDS FOR OFFICES
Build Serv Engr, v 41, Jan 1974, p 223-230

Criteria set to determine the principal design parameters and acoustical standards of any building discussed include the background or ambient noise level; the reverberation time or absorption of the area; and the vibration limits of the building structure.

Wiethaup, H.
DIE LAERMBEKAEMPFUND BEI GAST-UND SCHANWIRTSCHAFTEN, BARBETRIEBEN USW. IN RECHTILICHER SICHT
Noise 2000, Assoc Intl Contre le Bruit, Intl Congr, 5th & 6th, (London, May 1968 and Groningen, Netherlands, May 1970

Apart from preventive noise abatement measures considered in planning and building, there are also numerous legal means of combating excessive noise from reastaurants, inns, etc. If the person(s) creating the noise will not end the disturbance in spite of detailed and energetic complaints, the person protesting can make immediate use of the legal possibilities outlined. Every owner of a public building should decide whether he would be willing to risk facing judicial measures in spite of justified protests against noise the protection of human health, takes precedence over all economic considerations.

Measurement

Brittain, F. H.
EXPERIMENTAL EVALUATION OF A SIMPLE METHOD FOR ESTIMATING SOUND TRANSMISSION CLASS IN BUILDINGS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, Oct 4-6, 1972, Wash DC

A simplified procedure for estimating sound transmission class of a wall in a building is proposed, and the validity and accuracy of using a single third point to determine SPL was evaluated. The capability of a single speaker (with and without rotating vanes) at a third point to produce a diffuse sound field in the source room was also analyzed. Measurement of SPL at third points gave statistically valid results, and the presence or absence of rotating diffusers had little effect upon the results of A-weighted SPL measurements. Accuracy at lower frequencies was a problem.

Langhe, R.
UPPMATNING AV EN HALLS LJUDEGENSKAPER (SOUND VARIATIONS WITHIN A HALL)
Inst Verkstadstek Forsk, IVF Resultat 73629, Dec 1973

An accurate, simplified method for sound measurements is described. The method is divided into two parts. One part gives instructions on how a direct measurement with a sound level meter and a source of sound will give the desired value of the sound decay. The other part gives instructions on how a sound decay can be calculated from reverberation time, volume and surface area of the room. In Swedish with English Abstract.

Warring, R. H.
NOISE IN BUILDINGS
Noise Control Vibr Reduct, v 4 n 6, Nov-Dec 1973, p 244-247

The basic problem of measuring acoustic noise is considered first, then the relation to noise abatement of building structure and room layout is examined. As for noise measurement, the several units used to express it are explained and evaluated as to their significance respecting speech interference and noise-induced hearing loss in relation to exposure to noise of various intensities. It is pointed out that the common unit of sound pressure in dBA (above some datum) ignores the spectral content of the noise (e.g., impulsive high-frequency as from typewriters, or pure tones) which may be subjectively more undesirable than the pressure level might imply. Subjective assessments of office noise levels are compared in terms of the several units available: dBA, loundness level (LL, in phons), noise rating (NR, in noys), and noise criterian curves (NC, in phons, subjectively related to frequency octave bands). Maximum background levels recommended for offices are also compared using dBA, NR and NC units.

HVAC Systems

Brockmeyer, H.
RAUMKUSTIK (SPACE ACOUSTICS)
Kaeltetfch-Klim, v 25 n 4, Apr 1973, p 19-22

The demands for acoustical conditions of air conditioned spaces usually go hand in hand with the requirements for thermal and other room conditions. When determining these in advance, it is not enough to take into consideration the acoustic characteristics of the air outlets. Attention should also be paid to the interrelationship between the space and the air outlet. Various examples illustrate the effect of this relationship and the consequences for the planning of the acoustic space conditions. In German.

Clain, F.
NOISE IN JET-CONVECTORS (LE BRUIT DES EJECTOCONVECTEURS)
Heat Transfer, Intl Inst Refrig, Pergamon Pres, 1971, p 489-495, N.Y.

The purpose of the study was to determine sound problems created by the operation of air conditioning equipment located directly in air conditioned rooms. The noise level of different jet-convectors was measured in a reverberation room. The results show how these levels evolve in terms of the static pressure in the container carrying the nozzles. 1 ref. In French with English summary.

Clark, R. J.; Petrusewicz, S. A.
NOISE IN DOMESTIC CENTRAL HEATING WATER SYSTEMS
Build Serv Engr, v 40, Jan 1973, p 219-227

To study the noise emanating from the pump a complete spectrum analysis, preferably using a narrow band analyzer, was essential, but with intensities of the order of 35 EM -- 40 dBA at the pump and even less at the radiator, it was difficult to eliminate the background noise from the measurements, without full anechoic facility. The use of vibration spectrum analysis obtained on a specially designed rig was found to be more practical, and with the pass curves obtained, the noise potential of the pump was established. Some practical aspects of system design are considered.

Fricke, F. R.
NOISE INSIDE BUILDINGS DUE TO EXTERNAL AIRFLOW
Appl Acoust, v 5 n 3, July 1972, p 233-235

The noise inside high-rise buildings due to external and internal airflows (other than air conditioning and compressed air supplies) is to be studied, under a science research council grant, at the Institute of Sound and Vibration Research, University of Southampton. This work forms part of a study of the internal environment of buildings due to meteorological factors such as wind and temperature, other studies being of ventilation, heating, lift and door operations and smoke movement. 3 refs.

Robers, W. L.
EXPERIMENTS USING AN ACTIVE DUCT TERMINATION TO CONTROL ACOUSTIC IMPEDENCE
AHSRAE Trans, v 79, Part 2, 1973, Paper 2292, RP-53, p 167-171

Study of the possibilities of practical application of sound concepts to problems of air or water carried in ducts used in the air conditioning industry; experimental systems using three fixed-position microphones and maximum/minimum microphone probe are discussed. 13 refs.

Sharland, I. J.
NOISE AND VIBRATION CONTROL IN AIR CONDITIONING SYSTEMS
Soc of Environ Engr, Environ Engr Aspects of Pollut Control, London, 1971, Symp held in London, England, June 22-23, 1971, Sect N

The options available for effective noise control may be summarized as follows: insure that the strength of the primary source (the soundpower) level of the fan is as low as possible consistent with the duty required; design the ducting system in such a manner that there is space to fit additional noise control devices; insure that secondary energy added at any point along the transmission path is less than the level of energy from the primary source at that point; and, prevent the breakout of energy from the system. 2 refs.

Zielinski, W, T.
AIR SYSTEM REDUCES COST, ENERGY AND NOISE
Actual Specif Engr, v 28 n 5, Nov 1972, p 93-95

The author describes the savings that resulted from the installation of a variable-volume air handling system in the Scott Plaza 2 office building in Philadelphia. Sound levels are also covered.

Noise Sources

General -

Carr, R. J.
SOUND CONDITIONING -- A NEW CONCEPT IN ENVIRONMENTAL ENGINEERING
Insulation (London), v 16 n 5, Sept-Oct 1972, p 223-227

Experiences have shown that the designer can derive valuable assistance in meeting the needs of office design by the use of sound conditioning. In essence an electronic technique for exercising control over the spatial background sound, and so obviating many noise problems within the occupied space.

Czarnecki, S.
NOISE CONTROL USING HELMHOLTZ RESONATORS
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

Two applications for Helmholtz resonators for noise control are discussed: increase of sound absorption area in rooms to diminish the average energy of reflected waves; and the application of resonators in ducts as acoustic filters. The opposite requirements in regard to the acoustic impedence in these applications are investigated and results are discussed.

Diamond, A. J.
BUILDINGS
Noise in the Environ; Cuases, Effects, Controls. Conf, Papers (Toronto, Ontario, Canada, April 28-29, 1971),

Reduction of airborne and structural-borne (impact) noises in buildings is discussed. Airborne noise comes through holes, grills, air conditioning ducts, cracks in walls, and suspended ceilings; structural borne noise occurs when part of a building's structure (e.g., pipes and columns) is hit and the noise travels through the building. Structural borne noise must be attenuated at its source, and a good way of avoiding such noise is by introducing a discontinuity in the structure or by padding the structure with absorbent material. Airborne noise can be prevented by mass (e.g., heavy walls). Approaches to noise control in buildings include: location and design modifications; suppression of noise at its source by manufacturers of noise-producing equipment; and baffling, masking, and absorbing noise.

Marggraf, D.
SCHALLGEDAEMPFTE DRUCKLUFT RAMMEN UND PFAHLZEIHER
Noise 2000, Assoc Intl Contre le Bruit, Intl Congr, 5th & 6th, (London, May 1968 and Gronigen, Netherlands, 1970)

The noise at large-scale building projects in the cities is attributable to a large variety of sources, pile driving and excavating being the loudest. Near the construction site, most impulse like noises reach levels exceeding 100 dBA. Developmental orders a German regional government placed with the industry resulted in extensive knowledge and most agreeable results so that pile driving with compressed air or steam regained its attractiveness an end to the intensive noise sources and reinstated commercial efficiency.

Nemecek, J; Grandjean Etiennes
NOISE IN LANDSCAPED OFFICES
Appl Ergonomics, v 4 n 1, May 1973, p 19-22

This paper deals with one part - noise and its disturbing effect - on an extensive study carried out in 15 landscaping offices in Switzerland. After an explanation of the method of noise measurement, the authors consider the results of a questionaire which examined annoyance, sources of noise, ability to concentrate, and causes of distractions. A statistical analysis was carried out on the relationship between noise effects and the room data. 4 refs.

Peutz, V.M.A.
QUASI-STATIONAIRE EN UITKLINKENDE GELUIDSVELDEN (QUASI-STEADY AND DECAYING SOUND FIELDS)
Ingenieursblad, v 42 n 18, Sept 16, 1973, p 469-475

Description of the characteristics of an experimentally obtained consistent phenomenological pattern of quasi-steady and decaying sound fields in large rooms. In Dutch.

Rettinger, M.
ACOUSTICAL DESIGN AND NOISE CONTROL
N.Y.: Chem Publ Co, 1973

Information on the physics of sound, room acoustics, noise, noise reduction, and room design is presented in a text designed for architects, engineers, planners, and builders. Specific aspects of design for minimal acoustic problems are discussed, including vibration control, absoptive treatment, barriers, water piping systems, mechanical rooms, integrated ceilings, and reverberation chambers. Problems in noise control for various types of rooms and buildings are presented. The harmful and often unexpected ways that noise can manifest itself in improperly constructed buildings and methods of control are reviewed.

Schreiner, J. R.
NOISE OF HOMES
Acoust Soc Amer, J, v 53 n 1, Jan, 1973, p 291-392

Homes are filled with products that provide comfort, convenience, and entertainment for the occupants and coincidentally produce noise. Most of these products operate only for short periods of time when users turn them on, but some cycle on and off continuously in response to automatic controls. Most are normally operated inside homes but some of the noisier ones are used outdoors and thereby contribute to community noise. Sound outputs vary widely between different types of products and to a lesser extent among different models of the same type, and many also vary with the mode or cycle of operation. The effects they produce also vary with the relative locations of the people exposed and their occupations at the time. While these factors add complications, considerable progress has been made on sound rating standards for many of these products, notably in the air conditioner industry, and quieter products will typically result from sound rating programs.

Smart, D.
A NEW CHARTED SYSTEM FOR THE SPECIFICATION OF STRUCTURE-BORNE NOISE CONTROL
Appl Acoust, v 5 n 3, July 1972, p 223-231

The practice of specifying noise levels in the various types of accommodation in buildings is increasing with the passing of each year. The architect employs various methods, the most commonly used being either NC or NR curves. This note provides, by the use of a set of simple charts, a method whereby vibration data may, in many instances, be directly related to sound pressure levels and, thus, TONC or NR curves. 3 refs.

Smith T.; O'Sullivan, P. E.; Oakes, B.; Conn R. B.; Harman, D. M.; Baade, P. K.; Mason, J. M.; Leventhall, H. G.; Bhattacharya, M. C.; Mulholland, K. A.; Crocker, M. J.; Marsh, J. A.; Scholes, W. E.; Salvidge, A. C.; Sargent, J. W.; Lewis, P. T.
BUILDING ACOUSTICS
Build Acoust, Ed Proc of Conf, Univ of Newcastle Upon Tyne, Apr 8-10, 1970, British Acoust Soc, Spec v 2, Oriel Press, Ltd, Newcastle Upon Tyne, England, 1971

Proceedings included 12 papers on building acoustics. Among the topics considered are traffic noise criteria for dwellings; equipment sound power measurement in reverberation rooms; the airborne sound insulation of glass; field performance of a noise carrier; the sound insulation of wood joint floors; and an improved technique for the measurement of airborne sound transmission in buildings. Following is Part I of the listings of 12 papers presented: Traffic Noise Criteria for Dwellings by D. M. Harman; Equipment Sound Power Measurement in Reverberation Rooms by P. K. Baade; Effects of Polymer Additives on the Internal Damping of Cement Mortar Beams by J. M. Mason and H. G. Leventhall; Propagation and Radiation of Sound Energy by Flanking Transmission Via Structural Junctions by M. C. Bhattacharya, K. A. Mulhaooland, and M. J. Crocker; Airborne Sound Insulation of Glass by J. A. Marsh; Field Performance of a Noise Barrier by W. E. Scholes, A. C. Salvidge, and J. W. Sargent; Real Windows by P. T. Lewis.

Trbuhovic, L.
SCHALLKOMFORT ALS PROBLEM DER UMWELTGESTALTUNG
Noise 2000, Assoc Intl Contre le Bruit, Intl Cong, 5th & 6th, (London, May 1968 and Groningen, Netherlands, May 1970)

The new attitude toward sound and acoustics in the architectural environment is considered. Acoustic properties as such, man as producer and consumer of sounds, as well as the perception of and sensitivity to acoustics were examined in detail, and the new hypotheses and proposals were clarified by examples and discussions of position. Observations relating to the architectural interior as a form of the environment inhabited by man are considered. In order to ensure him sonic comfort, man is initially considered as the object (construction of a new system of location and orientation of the spatial coordinates at eye and ear level); than as the subject (in terms of his faculties of spatial perception and the responses elicited by sound signals); finally, man-to-man relations. Measures of planning, technical production, and sound insulation in the created environment are described. These considerations show sound to be a component of the environment, and some aspects and criteria of a technical sonic nature that promote comfort and achievement are therefore taken into account.

Voelker, E. J.
AKUSTISCHE ANFORDERUNG AN GROSSRAUMBUEROS, DIE NOTWENDIGKEIT VON UEBERDECKENDEM DAUERGERABUSCH, (ACOUSTIC REQUIREMENTS OF OFFICES OCCUPYING LARGE AREAS, NECESSITY OF SUPPRESSED CONTINUOUS NOISE)
Frequenz, v 26 n 3, Mar 1972, p 78-82

The isolation of adjacent working groups is the primary problem in large-room offices. Interference produced by telephone calls, typewriter clatter and conversations must be masked by constant permanent noise. In some large-room offices this continuous noise is too soft; this depends on the kind of work and the purpose for which the room is used. A loudspeaker system offers the best opportunity for filling the entire room with a constant noise level. Such a system has been put into operation for large-room offices in several buildings. A report is given as to the kind of colored noise and the one-third octave filter equalizer, the number of loudspeakers and the monitoring instruments as well as other acoustic requirements. In German

Winzer, G. E.
FIELD STUDY OF RESIDENTIAL ACOUSTICS
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

A study dealing with noise sources in multifamily housing units is discussed. An apartment development in metropolitan Washington, D.C. was investigated during construction, and a survey of occupants was taken after a period of residence. Following a review of the design and construction of the buildings, and acoustical data, as well as the responses to the questionnaires, the problem areas were identified and defined, and recommendations were suggested for solving them.

Barrow, C. W.
QUIET ON THE SET!...NOISE CONTROL IN THEATERS
Actual Specif Engr, v 31 n 2, Feb 1974, p 108-111

In most theaters and auditoriums, there are three types of noises that must be controlled: ambient noises within the performing space; noises that originate in other spaces and are transmitted into the performing area by air, ducts or the sturcture; and environmental noises that intrude into the performing space. The author outlines several methods for designing a noise-controlled theater.

Ettouney, S. M.; Fricke, F. R.
COUTRYARD ACOUSTICS
Appl Acoust, v 6 n 2, Apr 1973, p 119-132

The acoustic environment of courtyard housing was studied, and the ability of the courtyard to attenuate external noise was examined. A scale-model was used to study the effect of the ground treatment, the source and receiver locations, the depth of the courtyard, and the position and arrangement of openings in the walls, Experimental results obtained from the model, together with a simple procedure for predicting the sound pressure levels inside the courtyard, are presented.

Mechanical Equipment -

Ostergaard, P. B.
SOUND IN BUILDINGS
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

The first step in mechanical noise control is to design a building in a manner which will isolate the noise sources from ciritical area. Mechanical noise sources in buildings are identified: fans, motors, pumps, refrigeration machines, and other types of mechanical equipment. Considerations in the design and construction of the mechanical equipment room, equipment selection, and silencing of duo systems are discussed. Of all the methods of noise control within building, the isolation of vibration is perhaps the most important. Factors to be considered in deciding what type of vibration isolation system must be installed are discussed: building structure, rotational speed and size of equipment, vibration isolation materials, and the noise levels desired.

Kingsbury, H. F.
HOW TO CONTROL MECHANICAL EQUIPMENT NOISE IN BUILDINGS
Actual Specif Engr, v 30 n 1, July 1973, p 79-88

This article provides step-by-step guidelines for determining the design level, calculating the required noise levels and selecting the proper equipment for mechanical equipment noise control in buildings.

Aircraft Associated -

Anon
COMFORT - CONDITIONED JET - AGE SCHOOL
Elec Constr Maint, v 70 n 2, Feb 1971, p 59-61

The windowless, heat-by-light Iroquis Junior High School in Des Plaines, Ill, is described. It is in jet flight path to O'Hare International Airport (about 2 mi distant). Soundproof construction proved natural for heat-by-light and BTU-pump application with double-duct air handling system.

Donato, R, J.
INSULATING HOUSES AGAINST AIRCRAFT NOISE
J Acoust Soc Amer, v 53 n 4, Apr 1973, p 1025-1027

A mathematical procedure establishes construction guidelines for reducing inside noise in houses near airports. A set of rules is derived for the choice of the component types of the envelope of a house or apartment from a knowledge of its acoustic properties, its relative areas, the degree of intrusive sound that may be tolerated, and the noise exposure forecast contours.

Hudson, R. R.; Crocker, M. J.
EXPERIMENTAL RESPONSE OF SIMPLE STRUCTURES TO SIMULATED SONIC BOOMS
Acustica, v 29 n 4, Oct 1973, p 187-197

Presents results obtained from an idealized model of a window under the influence of a sonic boom. The window was represented by a simply supported steel panel mounted at the end of an explosive-driven shock tube. In order to realize a simply supported panel the problem of providing edge support without clamping, damping or membrane stresses had to be overcome. The final panel had less than 1 percent critical damping and had a resonant frequency within 4 percent of the theoretical value. The panel strain was measured when it was subjected both to continuous wave and transient acoustic excitation. The continuous wave strain is within 5 percent of the theoretical value calculated from a modal theory. This theory, in conjunction with the Duhamel integral, also gives a prediction of the transient strain time-history which is in good agreement with the experimental curves. 11 refs.

Pym, F.
THE EFFECT OF SONIC BANGS ON BUILDINGS
Noise 2000, Assoc Intl Contre le Bruit, Intl Congr, 5th & 6th, (London, May 1968 and Braningen, Netherlands 1970)

The wave motion from a single boom with a extra overpressure of 1 lb/ft^2 has a sharp rise at the beginning and a gradual fall away. The wave motion of a sonic boom of the magnitude tested over London recently differs in that it has a second shock wave immediately following the first which creates the characteristic double boom. One of the difficulties with sonic booms is the peculiar shape of the double boom, inducing resonance, thereby considerably increasing the effective power of the boom. Adverse effects on building components such as plate glass, steel, masonry, or timber are briefly considered. The most serious point and a real concern which has not yet been studied is that of the cumulative effect of prolonged vibration from sonic boom impulses which will occur if they become part of everyday life. Specifically, the effects of sonic booms on historical structures in Great Britain are considered in light of the economics involved in preserving the landmarks vs. supersonic transport.

Speckhan, H.
SCHALLSCHUTZMASSNAHMEN GEGEN FLUGLAERM IN SCHULEN (MEASURES OF SOUND PROTECTION IN SCHOOL BUILDINGS AGAINST AIRCRAFT NOISE)

HLH, Zeit Heizung, Lueftung, Klim, Haustech, v 24 n 6, June 1973, p 181-188

The author deals with the question of aircraft noise protection in the form of studies and of investigations and to publish the results. The impairment of the teaching by aircraft noise was systematically checked and observed and taken into account at the investigation. 14 refs. In German.

GENERAL INTEREST PAPERS ON NOISE

Damping and Absorption

Damping Materials -

Anon
PLASTICS PUT THE DAMPER ON NOISE
Mod Plast, v 49 n 7, July 1972, p 42-45

In this review some plastics applications in noise-pollution control are discussed from property, technological, performance and legislative points of view. Properties and performance of some soundproof polyurethane foams available on the market are presented. Use of plastics engineering parts to replace metallic ones is indicated. Forecast for the future development is included.

Anon
SOUND CONTROL MATERIALS LET THE SOUND OF SILENCE BE HEARD
Product Engr, New York, v 43 n 10, p 26-27, Oct 1972

Noise control materials that absorb sound, prevent sound transmission or damp vibration are described. Foams and fiber materials can cut as much as 10 dB from reverberating sound levels; the most commonly used of these absorbents are glass and mineral wools. Another form of sound absorbing material is open- or semi-open-celled plastic foam. Lead is the best and most widely used sound barrier material, and leaded plastics can be bonded to noise generating surfaces or used as enclosures. Materials that muffle noise by damping vibration include epoxy, latex, and asphaltic sheets, or pastes. Plastics are also effective for stifling noise.

Behar, A.; Taibo, L. N.
MEASUREMENT OF THE EFFICIENCY OF DAMPING MATERIALS
Acustica, v 30 n 1, Jan 1974, p 60-64

The SAE J671/58 Standard deals with the measurement of all properties of sound dampers and underbody coatings. With respect to the acoustical measurements, there are only general specifications about what to measure and how to measure it. The object of the present study is to supply detailed information about the practical realization of the measurement itself. Experimental results are supplied, and special attention is paid to the reliability and the accuracy of the method proposed. 6 refs.

Burns, J. J.
THE USE OF ASPHALT-MASTICS FOR ACOUSTICAL DAMPING
Sound and Vibr, Cleveland, v 6 n 10, p 4,6,8, Oct 1972

Viscoelastic substances, such as blended asphalt-mastics, are effective inexpensive, and easy to use vibration damping materials. In acoustical laboratory tests the addition of asphalt-mastic damping materials increased the sound transmission loss rating of an untreated panel from 7 to 12 points. In wood stud wall paneling, floor-ceiling construction, and suspended ceiling construction, the asphalt-mastics materials increased the sound transmission loss ratings significantly. In most cases where acoustical damping is required, a one-piece material that includes all of the desired components can be provided.

Meteer, C. L.
APPLICATION OF LEAD-VINYL NOISE BARRIERS IN TRANSPORTATION EQUIPMENT
SAE Paper 720222 for Mtg Jan 10-14, 1972

Lead Vinyl coated fabrics, new composite vinyl films, and molding compounds have been developed that have application as flexible sound barriers in transportation and recreational equipment. The materials, consisting of fine lead particles disbursed in PVC compounds for coating, casting films, extrusion, injection molding, thermal form sheets, and rotational casting, combines the high mass of lead and the properties and formability of vinyl. These composites provide a limp high mass sound barrier material.

Meteer, C. L.
SOUND CONTROL WITH HIGH DENSITY COATED SUBSTRATES
J Coated Fibrous Matl, v 2, Oct 1972, p 68-78

Lead vinyl coated fabrics, new composite vinyl films, and molding compounds have been developed that have application as flexible sound barriers in transportation and recreational equipment. The material consisting of fine lead particles disbursed in PVC compounds. 4 refs.

Wald, B.
RIGHT MATERIALS FOR WRONG NOISES
Des Engr, v 19 n 6, June 1973, p 40-41

The article presents elementary discussions of various noise control concepts. Absorption, barriers, damping, and isolation are examined relative to applications, materials, and measurements.

Warnaka, G. E.; Miller, H. T.
COMBINED EXTENSIONAL AND CONSTRAINED DAMPING FOR BROAD TEMPERATURE AND FREQUENCY PERFORMANCE
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C., Oct 4-6, 1972

The use of polymeric damping materials to broaden the temperature and frequency ranges of constrained layer laminates was investigated. Damping materials with different temperatures of peak damping can be used so that one of the materials acts at or near its optimum temperature when the laminate is exposed to a wide range of temperatures. The mechanical properties of polymeric damping materials are analyzed, and the composite shear modulus and loss factor of two combined layers is computed.

A configuration of two outer metal layers with two different elastomeric damping materials sandwiched in between is presented. The entire assembly is rigidly bonded together at all interfaces.

Vibration Isolation -

Harvey, S. G.; Oliver, C. C.
CLASSIFICATION AND PERFORMANCE OF COMMERCIAL VIBRATION ISOLATORS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, Washington, D.C.
Oct 4, 1972

Stiffness, damping, and vibration tests were performed on prefabricated isolator systems which interrupt transmission paths of noise and vibration. Stiffness coefficients were in approximate agreement with catalog data on the isolators, but the majority of the isolators had higher values than the catalogs indicated. Spring isolators demonstrated wave effects with excessive noise generation at one or more frequencies. Type A isolators exhibited noise generation at points of connection between spring coils and upper and lower plates and between lower coils during heavy loading. Noise generation from inner part suspensions in B type isolators were also evident. Isolator Types C and D did not display resonances comparable to theoretical undamped natural frequency calculations. Dynamic excitation of isolator systems increased effective stiffness.

Junger, M. C.
EFFECTIVENESS OF RESILIENT ELEMENTS FOR NOISE VERSUS VIBRATION CONTROL
ASME AMD, v 1, 1973 for Meet, Cincinnati, Ohio, Sept 1973, p 173-191

Introduces the mechanical engineer versed in vibration isolation to guidelines in the use of resilient elements in noise control techniques. Current use of these elements in enhancing the transmission loss of masonry walls, floors, panels, and windows is described. Criteria for the effectiveness of resilient elements in controlling airborne as opposed to structure-borne noise will be shown to differ significantly in certain situations. Finally, the principle underlying a novel use of resilient elements to enhance the transmission loss of panels forming an acoustic hood is described. 20 refs.

Thorn, R. P.
VIBRATION ISOLATION AND THE USE OF CONTROLLED FLEXIBILITY FOR NOISE REDUCTION
Inter-Noise 72, Intl Conf on Noise Control Engr Tutorial Papers,
Washington, D.C., Oct 4-6, 1972

Vibration isolation concepts applied to noise control are discussed. These concepts provide a powerful technique for controlling dyanmic response, load, motion, and energy transmission and dissipation. A spring/damper combination vibration isolator which offers a cost effective solution to noise control is described.

Absorption -

Crocker, M. J.
ABSORBING MATERIALS
Inter-Noise 72, Intl Conf on Noise Control Engr Tutorial Papers,
Washington, D.C., Oct 4-6, 1972

Calculation of the average absorption coefficient and reverberation time of absorbent materials is described. The use of a Helmholtz resonator and acoustic tiles is also discussed.

Dunn, R. L. (ed)
SPECIFICATIONS CHART FOR NOISE CONTROL PRODUCTS
Lant Engr (Barrington, Ill), v 26 n 25, Dec 14, 1972, p 82-89

Applicable materials for noise attenuation, such as lead, mineral fiber, felt, fiberglass, and combinations of materials, manufacturers recommended applications, and acoustical properties are described and listed in chart form.

Hochheiser, R. M.
HOW TO CONTROL NOISE
Plant Engr (Barrington, Ill), v 26 n 20, Oct 5, 1972, p 90-93

Design and selection factors for acoustical sound barriers are evaluated. Methods for eliminating noise at the source, plus the acoustical properties of commonly used insulating materials are included.

Jhaveri, A. G.
THEORETICAL CONSIDERATIONS IN THE DETERMINATION OF COMPLEX ACOUSTICAL IMPEDANCE OF NONLOCALLY REACTING NOISE CONTROL MATERIALS
Acoust Soc Amer J, v 53 n 1, p 291-392, Jan 1973

Various techniques and computer programs have been developed for the determination of complex acoustic impedance of thin (locally reacting) noise control materials, such as metal felt, polyimide, perforated plate, etc., within the last five years. However, there is very little published data available for the calculation of complex impedance and absorption coefficient of thick, homogeneous, and nonlocally reacting noise control material such as glass fiber and open-pore polyurethane foam. Theoretical guidelines are established for the computation of acoustical parameters that determine the complex acoustical impedance of porous, homogeneous and isotropic materials. These materials have been and are being used for the abatement and control of air conditioning and airborne types of environmental noise. A thick or nonlocally reacting type of material is characterized by two complex numbers, namely, the characteristic impedance, and the propagation constant, as opposed to only one complex number for thin or locally reacting materials. Then two separate measurements based on theoretical equations contained herein yielding two complex numbers, would suffice in the determination of required complex acoustic impedance and absorption coefficient as a function of discrete frequency.

Manson, L.; Lieberman, S.
SOUND PROPAGATION AND ABSORPTION IN FOAM: A DISTRIBUTED PARAMETER MODEL
Acoust Soc of Amer J, v 50 n 4, Oct 1971, p 1075-1080

Liquid-base foams are highly effective sound absorbers. A better understanding of the mechanics of sound absorption in foams was sought by exploration of a mathematical model of bubble pulsation and coupling and the development of a distributed parameter mechanical analog. A solution by electric circuit analogy was thus obtained and transmission-line theory was used to relate the physical properties of the foams to the characteristic impedance and propagation constants of the analog transmission line. Comparison of measured physical properties of the foam with values obtained from measured acoustic impedance and propagation constants and the transmission line theory showed good agreement. It may therefore be concluded that the sound propagation and absorption mechanisms in foam are accurately described by the resonant response of individual bubbles coupled to neighboring bubbles.

McAuliffe, D. R.; Agne, T. D.; Hammond, J. I.
MATERIALS FOR NOISE AND VIBRATION CONTROL
Sound and Vibr, Cleveland, v 6 n 7, July 1972, p 20-24

Four types of materials are available for dealing with noise and vibration control problems: sound absorption materials, sound barrier materials, vibration/shock isolation materials, and vibration damping materials. Two or more of these materials are often incorporated in a single commercial product to obtain the benefits of their combined effects. Properties of these materials and their performance when used singly and in combination are discussed. Transformer enclosures, engine test cells, appliance enclosures, railroad wheels, and pipes and valves illustrate typical application of noise/vibration/shock control materials.

Nordby, K. S.
ATTENUATION OF NONMETALLIC PANELS
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C.
Oct 4-6, 1972

Attenuation data on nonmetallic panels and acoustically tight enclosures made from bare panels are reported. Panels showing high attenuation include ABS sheet, glass filled polyester, polyvinyl chloride, ABS foam, plexiglas, and safety glass. Low densities are detrimental to attenuation. Increasing the thickness of the panel results in an increase in attenuation at low frequencies for al and plexiglas. The attenuation provided by a tight enclosure depends on absorptivity of internal surfaces, noise source location, radiation impedance, and impedance of surface in source proximity.

Shippee, E. G.
MATERIALS FOR NOISE ABSORPTION
Pollut Engr, v 5 n 1, Jan 1973, p 37-38

In some cases a noise problem may be solved by merely adding sound absorbing materials to a room. This type of treatment can be effective when the room has highly reflective surfaces, if the noise is intermittent or discontinuous, where the operator's station is not too close to a continuous source, and if the sound level is greater than 100 dBA.

Tsao, M.C.C.; Musa, R. S.
TRANSIENT AND STEADY STATE SOUND ABSORPTION COEFFICIENTS OF FIBERGLASS AND POLYURETHANE FOAM
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C.
Oct 4-6, 1972

The average normal absorption coefficients (350-4,000 Hz) of fiberglass and polyurethane foam of different thicknesses were obtained by impedance tube and short pulse methods. Oblique incidence tests were performed on fiberglass at an incidence angle of 30 degrees and the directivity of the speaker was considered. The oblique sound absorption coefficient was higher than the normal absorption coefficient. The pulse method was better than the impedance tube method for obtaining sound absorption coefficients for engineering purposes.

Noise Surveys

Sources -

Caccavari, C.; Schechter, H.
BACKGROUND NOISE STUDY IN CHICAGO
J Air Pollut Control Assoc, v 24 n 3, Mar 1974, p 240-244

The Chicago Department of Environmental Control has begun a program to establish "baseline noise" levels within the City of Chicago. The procedure provides a 24 hr noise signature in dBA at each preselected location and also can be expanded to depict a statistical plot of the noise for every 15 min of the 24 hr period. A detailed discussion of the procedure is presented.

Fisher, G. H.
CURRENT LEVELS OF NOISE IN AN URBAN ENVIRONMENT
Appl Ergonomics, v 4 n 4, Dec 1973, p 211-218

Studies made throughout 1971 are described, in which both peak and ambient noise levels prevailing inside and outside buildings were measured and found greatly in excess of those regarded as tolerable ten years previously. Two methods for reducing noise level were considered. First, a barrier designed with the primary intention of reflecting rather than absorbing noise; secondly, a relatively simple form of double-glazing fitted to existing window frames. The barrier reduced peak noise levels but failed to influence ambients. Double-glazing attenuated both peak and ambient noise levels significantly. Noise generated within buildings themselves may become a source of discomfort for occupants and of annoyance to those outside. Noise levels rising beyond 100 dBA were measured during evening business in the bar of a local hotel. A summary of data referring to noise levels in the outdoor environment reveals that the upper tolerance limits prescribed by ISO are now being exceeded by 20 dBA, or more, throughout 18 hrs of the day. 12 refs.

Furrer, W.; Lauber, A.
RAUM-UND BAUAKUSTIK; LAERMABWEHR
Birkhaeuser Verlag Basel, Switzerland, 1972

The acoustic properties of localities ranging from classrooms to churches and concert halls and the techniques of soundproofing and noise abatement in apartment houses, hotels, hospitals, and on streets are discussed. The fundamental principles of acoustics, room acoustics, and architectural acoustics and noise standards are surveyed.

Koczkur, E.; Broger, E. D.; Henderson, V. L.; Lightstone, A. D.
NOISE MONITORING AND A SOCIOLOGICAL SURVEY IN THE CITY OF TORONTO
J Air Pollut Control Assoc, v 23 n 2, Feb 1973, p 105-109

To establish the ambient sound levels, a comprehensive system for measuring sound has been established for points on a predetermined orthogonal grid superimposed on a topographical plan of the city. Measurements are made to provide a statistical sample of the sound level at each of these points over a period of 24 hrs. These data are used to produce graphs and charts showing the range of noise levels during each sampling period. The proportion of time during which any chosen level is exceeded, daytime levels, nighttime levels, and the maximum level reached.

Price, A. J.
COMMUNITY NOISE SURVEY OF GREATER VANCOUVER
J Acoust Soc Amer, v 52 n 2, part 1, Aug 1972, p 488-492

A survey involving 100,000 individual noise measurements in the greater Vancouver Regional District, B.C., Canada, extended over a land area of about 560 square miles. Statistical noise climate in residentially zoned areas was almost identical in level distribution to that previously found by Donley in Mid-Atlantic states.

Community Noise -

Biship, D. W.; Simpson, M. A.
CORRELATIONS BETWEEN DIFFERENT COMMUNITY NOISE MEASURES
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C. Oct 4-6, 1972

Noise levels in light and heavily trafficked areas of Boston, Detroit, Los Angeles, Portland, and Honolulu were measured, and recorded noise signals were played back through the A-weighting network of a sound level meter into a statistical distribution analyzer. The following information was obtained: Noise levels exceeded 1, 10, 50, and 90 percent of the time; noise pollution level; and L-equivalent level. Regression lines were computed for data collected during daytime, evening and night, and correlation coefficients were found.

Siddon, T. E.; Harford, K. D.
A LOW COST APPROACH TO AREA-WIDE COMMUNITY NOISE MONITORING
Acoust Soc of Amer J, v 5 n 1, Jan 1973, p 291-392

A new approach to noise survey work emphasizes the importance of spatial and temporal noise level variations with less stress on frequency content. A low cost sound monitoring package, A-weighted at the input stage, and with a dynamic range of 45 dB , yields adequate information on which to base a concise, statistical model of the acoustic landscape. Because of the low cost of individual terminal units, a large number of units may be operated over an extended land use area. This ensures that important spatial information is not lost. Such a detailed picture is not possible with the more conventional sequential (point to point) techniques that are normally employed. The format for a typical area-wide noise level survey is presented, and the usefulness of the data obtained to urban planners and legislators is briefly described.

State-of-the-Art -

Fisk, D. J.
STATISTICAL SAMPLING IN COMMUNITY NOISE MEASUREMENT
J of Sound and Vibr, v 30 n 2, Sept 22, 1973, p 221-236

The statistical theory of community noise sampling is investigated and used to derive the optimum sampling procedures. General expressions are given for the sampling errors and other percentiles. The correlation between percentile sampling errors is discussed in relation to the sampling error in TNI and to the correct procedure of data analysis. The traffic noise models of Weiss and Kurze are used to derive a sampling theory. The model is used to demonstrate that, when sampling is taken with a sound level meter and a fixed number of readings, the readings should be at least 5 sec apart. Very short analogue tape samples (microsampling) lead to improved sampling accuracy on theoretical grounds.

Szecsody, A. J.
STATE OF THE ART IN NOISE SURVEYS
J Audio Engr Soc, v 20 n 7, Sept 1972, p 574-579

The results of a literature search to determine the methodology to conduct a community noise survey are presented. It was found that a wide range of methods are available to conduct such a survey. Essential electronic hardware and software are currently available and are capable of supporting any method chosen. 26 refs.

General -

Attenborough, K.; Wallis, D.
LARGE SCALE NOISE SURVEYS: AN EDUCATIONAL EXPERIMENT
Acustica, v 28 n 5, May 1973, p 290-295

This paper describes how the multimedia educational system at the open university, including correspondence texts, home experiments, the student computer service, summer schools and the computer marked assignment procedure, allow the conduct of several large surveys of noise, 5 refs.

Haag, F. G.
EDUCATION BY NOISE CONTROL PROJECTS
Acoust Soc of Amer J, v 52 n 1, July 1972, p 112-188

Noise control presents many interesting possibilities for student-project-type courses. The projects provide a natural motivation at a low cost to education benefit ratio. Projects have been successfully conducted with undergraduates in general education, and with undergraduate and graduate engineering students. Among the most recent projects are effect of snowmobile noise on mice, standing wave tube, visible sound apparatus, computer simulation prog[illegible] muffler design, wave-tank analogy, noise reduction demonstrator, no[illegible]llation device, noise reduction of a computer card reader, [illegible] ffect of noise on plants. Since most noise control projects inv[illegible]udent in value judgments, an auxiliary education benefit res[illegible]

Maineri, R. P.
NOISE CONTROL
J Amer Soc Safety Engr, v 17 n 3, Mar 1972, p 20-25

It is stressed that an acoustic engineering survey is the first step in a noise control program to determine the extent of a problem, serve as a basis to decide on suitable noise control measures, and is useful to evaluate effectiveness of these measures. The source, path, and receiver of noise act as links in a chain, and these must be properly evaluated for treatment.

Ducts

Theory -

Bolleter, U.; Crocker, M. J.
THEORY AND MEASUREMENT OF MODAL SPECTRA IN HARD-WALLED CYLINDRICAL DUCTS
J Acoust Soc Amer, v 51 n 5, part 1, May 1972, p 1439-1447

A method is given by which the pressure and power spectral densities for the first nine acoustic cross modes in ducts can be determined from pressure cross spectrum measurements. Modal spectra and some of the modal interaction terms are given for a number of fans. 26 refs.

Khosrovani, H.; Cohen, R.; Chanaud, R. C.
RESPONSE OF A THIN-WALLED CYLINDRICAL DUCT TO INTERNAL AIRFLOW
J Acoust Soc Amer, v 50 n 1, part 2, July 1971, p 241-247

An experimental and theoretical study is made of the vibration of a thin cylindrical duct, due to internal random pressure field caused by airflow. Although a muffler was used to simulate acoustically a much longer duct, the acoustic pressure was found to be a significant cause of duct vibration. A simple white noise model of the pressure field was derived and compared with measured displacement data.

Impedance -

Zorumski, W. E.
GENERALIZED RADIATION IMPEDANCES AND REFLECTION COEFFICIENTS OF CIRCULAR AND ANNULAR DUCTS
Acoust Soc of Amer J, v 54 n 6, Dec 1973, p 1667-1773

Mores's equation for the radiation impedance of a vibrating rigid piston is extended to give the generalized radiation impedances Z_{mnl} of all modes in circular and annular ducts which have arbitrary wall admittance and which terminate in an infinite baffle. The equation for Z_{mnl} is reduced to a single infinite integral which is a function of the mode radiation directivity factors. An infinite matrix equation is derived which relates the generalized mode reflection coefficients to the radiation impedances. The duct-wall admittance is a significant parameter in the effect of duct-termination reflections and mode-coupling reflection effects may be more important than direct-mode reflection effects.

Pipe Covering and Lined Ducts -

Dear, T. A.
NOISE REDUCTION PROPERTIES OF SELECTED PIPE COVERING CONFIGURATIONS
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C., Oct 4-6, 1972

Nineteen pipe covering materials were tested for their ability to reduce noise generation within a pipe. Lead impregnated vinyl was excellent for suppressing noise, and 3- and 5-in. thick amosite asbestos coverings did not perform as well as 1- and 2-in. thick coverings; a 2-in. fiberglass spacer was superior to a 3-in. fiberglass spacer. None of the coverings demonstrated good noise reduction below 500 Hz. Proper sealing of all joints in the pipe covering envelope was critical, and a layer laminate pipe showed true structural damping.

Bokor, A.
ATTENUATION OF SOUND IN LINED DUCTS
Noise and Vibr Control Engr Conf Proc, Lafayette, Ind. July 14-16, 1971

Scott's equation, predicting the attenuation of sound in ducts lined symmetrically on two sides, is tested experimentally with some success for the first mode of propagation only. A method of measurement of the acoustical bulk properties of a lining material is described. These are required for substitution into Scott's equation. Measurements were made in a lined standing wave tube of variable rectangular cross section. When necessary, the in-duct attenuation and wave length constants were measured in the presence of standing waves. Solutions of Scott's equation are given for a representative selection of duct dimensions, lining materials and frequencies. The performance of various lining materials, whose bulk properties are shown, are compared on the basis of their effectiveness in ducts of identical geometry.

Melling, T. H.; Doak, P. E.
BASIC DESIGN CONSIDERATIONS AND THEORETICAL ANALYSIS OF DOUBLE REVERBERANT CHAMBER DUCT LINING TEST FACILITIES
J Sound Vibr, v 14 n 1, Jan 8, 1971, p 23-35

A duct liner test facility theoretical model is established, yielding the acoustic behavior of the test section alone. The measurements for the interpretation of the test section performance are discussed. Models of the attenuation in the test section are presented for correlation with theoretical models of acoustically treated ducts. Two principal features of the analysis are that it includes the following effects--that of flow on the acoustic fields as well as on the absorption; that of possible variations in the impedance of the terminating chamber, e.g., it could be anechoic rather than reverberant. 6 refs.

Morfey, C. L.
SOUND TRANSMISSION AND GENERATION IN DUCTS WITH FLOW
J Sound Vibr, v 14 n 1, Jan 8, 1971, p 37-55

Sound generation in hard walled ducts with flow is treated theoretically. Axial standing waves are allowed for in the theoretical model, by applying an impedance boundary condition at the ends of the duct. The results show the effects of axial and swirling flow on the radiated sound power, for different types of source contained in the duct. Suggestions are also put forward for analyzing the generation of sound by sources at a mean flow discontinuity. 22 refs.

Scott, H. L.
OPTIMIZATION OF SOUND ABSORBERS IN CIRCULAR DUCTS
J Sound Vibr, v 16,n2, May 22, 1971, p 189-222

A classical wave theory approach is used to relate the acoustic impedance at the duct wall to the axial attenuation rate. The solution is presented graphically to facilitate application of the technique.

Vaidya, P. G.; St Hilaire, A.
EXTRANEOUS MODES IN SOUND ABSORBENT DUCTS
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C., Oct 4-6, 1972

Sound transmission and attenuation in lined ducts is discussed, with emphasis on the generation of extraneous modes. A technique for the analysis of nonuniform wall impedance is presented; in this technique, impedance has a specific dependence on length. Extraneous modes generated under such conditions might contribute to instabilities in flow ducts lined with porous materials.

Wirt, L. S.
ANALYSIS, TESTING, AND DESIGN OF LINED DUCTS
J Acoust Soc Amer, v 51 n 5, part 1, May 1972, p 1448-1463

A new method is given for analyzing lined ducts that contain flow and intense sound. A duct test facility was built, giving equipartition of energy. The impedance of nonlinear materials was redefined and measurement methods modified. Contours of equal duct attenuation in the impedance plane were generated and proved to be simple in shape. From these a design methodology was deduced, applicable to any linear material and leading directly to the creation of new liner materials. 10 refs.

Sources of Noise and Basic Phenomena

Sources -

Anthrop, D. F.
NOISE POLLUTION
Lexington Books, D. C. Heath & Co, Lexington, Mass, 1973

The physical concepts of noise and its measurement are described. Subject areas include sound as noise, noise in dwellings, construction noise, motor vehicle noise, and aircraft noise.

Bartheld, R. G.
HOW TO SPECIFY AGAINST NOISE
Actual Specifying Engr, v 25 n 5, May 1971, p 128-31

Industries have long been aware of community displeasure with objectionable noise levels and that employees run the risk of damaging their hearing when required to work in noisy areas. Understanding noise and its measurement can help establish specifications to lessen the din in problem areas.

Bhattacharya, B.
AN ANALYSIS OF THE PROBLEM OF NOISE IN THE URBAN AREAS
Environ Pollut and Its Control, Inst of Engrs, Baroda Sub-Centre,
Baroda, India, April 15-17, p 24

An analysis of the sources, effects and control methods of urban noise in India is presented.

Bhavnani, H. V.
NOISE POLLUTION
Environ Pollut and Its Control, Inst of Engrs, Baroda Sub-Centre,
Baroda, India, April 15-17, p 24

Various sources of noise are discussed and control methods are described. It is suggested that the government pass resolutions regarding traffic noise, social noise, and occupational noise.

Shaw, E.A.G.; Olson, N.
THEORY OF STEADY-STATE URBAN NOISE FOR AN IDEAL HOMOGENEOUS CITY
J Acoust Soc Amer, v 51 n 6, part 1, June 1972, p 1781-1793

A noise theory treats a city as a plane surface with many identical sound sources, such as motor vehicles, randomly distributed. The mean energy density at any point is expressed in terms of the source strength, the average number of sources per unit area, the atmospheric absorption constant and a shielding factor to account for obstacles in the transmission path. Data are given for Ottawa.

Equipment Sources -

Bender, E. K.
NOISE FROM CONSTRUCTION, HOME APPLIANCES, AND BUILDING EQUIPMENT
J Environ Sci, v 15 n 5, Sept-Oct 1972, p 9-18

Summary of the results of a recent study of noise from construction equipment, building equipment, and home appliances, for each of these categories. It is attempted to characterize the sources of noise to evaluate the impact of each source, and to determine what pressures have been brought to bear upon industry and what the response of industry has been. 7 refs

Cummins, D. P.
IDENTIFYING AND REDUCING RADIATED NOISES
ASME Paper 72-DE-36 for Meet May 8-11, 1972,

Identification of source is accomplished through use-human ear; precision sound level meter; and 1/3 octave band analyzers. Reducing noise levels can be accomplished by 'designing out' noise or containing it. 'Designing out' includes reducing pump and motor rpm; use of flange mounted pumps; isolators for components and major subunits; use of manifolds; and isolators in hydraulic lines.

Mitchell, L. D.; Lynch, G. A.
ORIGINS OF NOISE
Machine Design, May 1, 1969

The identification of noise sources is discussed. Noise sources can be determined by analyzing emitted noise and tracing components of the spectrum back to the specific design features of the component. The goal of a noise analysis is to associate the frequency (rate of occurrence) of the noise with the fequency of some specific mechanical event in the offending equipment. Electronic filters are usually used to divide the overall noise signal into a series of noise levels associated with specific frequency ranges. Two types of filter systems used in studying acoustic problems are described, and spectrum analysis is examined. Diagnosis of noise problems is made.

Schaudinischky, L. H.; Schwartz, A.
SPORTS GROUND AS A NOISE SOURCE
Appl Acoust, v 5 n 2, Apr 1972, p 119-131

This paper investigates the modern sports ground from the acoustic viewpoint, paying particular attention to the two main types of noise source: (1) the 'direct' noise, produced on the sports field and in the stands, mainly by the human voice and (2) the 'indirect' noise, produced by traffic and other outside sources. After short theoretical and experimental explanations, the paper concludes with an analysis of some practical examples of newly constructed sports grounds. 1 ref.

Plate Noise Radiation -

Pinkel, B.; Scharton, T. D.
REDUCTION OF NOISE GENERATED BY FLOW OF FLUID OVER PLATE
J Acoust Soc Amer, v 53 n 4, Apr 1973, p 1184-1185

Communication to the editor describes a method of reducing noise generated by a fluid stream flowing subsonically over a plate. Applicability is for noise reduction of STOL aircraft using the externally blown flap or the augmenter wing. Test data for a crude model are included.

Tatge, R. B.
NOISE RADIATION BY PLANE ARRAYS OF INCOHERENT SOURCES
Acoust Soc Amer, New York J, v 52 n 3, Sept 1972, p 732-736

Calculation of sound-power level from close-in measurements of SPL is a common and continuing requirement in many industries. Some machines, because of size or operating cycle, must be tested in the field. At distant points, the ambient noise level may be too high to permit valid measurement of the noise of the device under test, and the characteristics of the propagation path between the source and distant microphone may be imperfectly understood. Under these conditions the source must be approached closely to make measurements. Generalized curves and a simple equation are developed by which the sound-power level of a plane array of equal, incoherent, simple sources can be related to the SPL at any distance. The array may have the form of a circular disk or a rectangle.

Tseo, G. G.
ACOUSTICAL RADIATION FROM A FINITE RECTANGULAR PLATE
Noise and Vibr Control Engr Conf Proc, Lafayette, Ind., July 14-16, 1971

Information about the sound generating mechanism of a finite plate is needed for noise control, since finite plates are commonly found to be sound-generating structures in machinery. A mathematical formulation is presented for determining the quantitative relationship between the vibration amplitude and the sound pressure (or radiation power) in order to determine the vibration sources contributing to the noise. Far field formulation is used to calculate the far field sound pressure and the radiation intensity from velocity data. The radiation efficiency is used to represent the relationship between the velocity and the radiation power. Radiation efficiencies were computed for various frequencies up to the 12th mode. The effects of area and aspect ratio were studied on the basis of the computed result. Some means of reducing the noise from the vibrating plate is also discussed.

Basics -

Acustica, v 27 n 4, Oct 1972, p 238-245
In this paper the distribution of the sound field in a circular infinite cylinder is studied. After having determined the exact solution by the classical method of development in series, one looks for an approximate solution by means of a simple layer potential. The integral equation which is obtained is solved by the method of discretization, this procedure is extended to find the characteristic frequencies. The results are compared. 3 refs. In French with Englis abstract.

Brozozka, G.
INDUSTRIAL INVESTIGATION OF NOISE BY MEANS OF CORRELATION TECHNIQUES (PRZEMYSLOWE BADANIA HALASU Z WYKORZYSTANIEM TECHNIKI KORELACYJNEJ)
Przegl Mech, v 30 n 1, Jan 19, 1971

Theoretical principles of correlation analysis are presented, and methods for determining the participation of discrete noise sources in the total noise field are explained. Practical examples are given of the application of correlation techniques to the noise measurement of various machine tools in a plant, an internal combustion engine, a diesel locomotive, and an automobile, as well as of applications to the determination of noise transmission paths and to studies on the acoustic insulation and sound absorption. In Polish.

Davies, H. G.
STATISTICAL ENERGY ANALYSIS OF SYSTEMS WITH POINT COUPLING
Noise and Vibr Control Engr Conf Proc, Lafayette, Ind., July 14-16, 1971

The random vibration of two multimodal systems coupled at a point is discussed. An exact expression is obtained for the spectral density of power flow from one system to another for arbitrarily large coupling strength. It is shown that by averaging the spectral density over narrow bands of frequency and by suitably defining a coupled modal energy the power-flow energy-difference proportionality of statistical energy analysis (SEA) can be recovered.

Delany, M. E.; Bazley, E. N.
NOTE ON THE SOUND FIELD DUE TO A POINT SOURCE INSIDE AN ABSORBENT-LINED ENCLOSURE
J Sound Vibr, v 14 n 2, Jan 22, 1971, p 151-157

It is shown that the field distribution due to a point source of sound within an absorbent-lined enclosure can be simply calculated using a geometrical ray treatment and the appropriate plane-wave pressure-reflection coefficient. A practical application of this result is in predicting the performance of free field test chambers of the type commonly used for industrial measurement of the sound power of noise sources. 4 refs.

Doelle, L. L.
ENVIORONMENTAL ACOUSTICS
Environ Acoust, McGraw-Hill Book Co, New York, 1972

A detailed analysis of environmental acoustics in architectural design is presented for practical application to present-day building practices. Properties of sound and various aspects of room or space acoustics are described. Environmental noise control, including sound-insulating construction, noise criteria, control of mechanical noise and vibration, and noise control in specific types of buildings, is discussed. Detailing, specification and supervision are included.

Duerden, C.
NOISE ABATEMENT
Noise Abatement, Philosophical Library, Inc., New York

The theory of sound and the physical properties of sound waves and their propagation are explained as background information for discussions of sound levels meters, investigations of noise complaints, noise control, and current legislation for noise reduction. The discussions of noise control and investigating complaints will be of special value to public health inspectors. A minimum of acoustic terminology is used so that the basic principles of acoustics may be introduced to the student, local government officer, and industrialist.

Georges, T. M.; Clifford, S. F.
ACOUSTIC SOUNDING IN A REFRACTING ATMOSPHERE
J Acoust Soc Amer, v 52 n 5, part 2, Nov 1972, p 1397-1405

Calculations are made for the general histatic case of acoustic echo sounding which can be used for displaying the dynamics of the boundary of the atmosphere. Effects are shown of the acoustic doppler shift, the change in direction of the axis which determines the component of the wind being measured, and the relocation of the scattering volume itself, in forms that explicitly show the magnitude of refractive corrections. 14 refs.

Graupe, D.; Krause, D. J.
ON THE IDENTIFICATION OF INPUT-OUTPUT-NOISE MODELS
Intl J Syst Sci, v 4 n 4, July 1973, p 617-621

The problem of consistently estimating all parameters of an input-output noise model is considered. It is shown that the parameters of the input-output (deterministic) part of the model may first be estimated consistently when a pure autoregressive structure of that part is considered. Subsequently, if a consistent estimation procedure of the noise model is employed, a consistent estimate of the parameters of the complete input-output-noise model is shown to be obtainable. 4 refs.

Greenwood, D. D.
MASKING BY NARROW BANDS OF NOISE IN PROXIMITY TO MORE INTENSE PURE TONES OF HIGHER FREQUENCY: APPLICATION TO MEASUREMENT OF COMBINATION BAND LEVELS AND SOME COMPARISONS WITH MASKING BY COMBINATION NOISE
J Acoust Soc Amer, v 52 n 4, part 2, Oct 1972, p 1137-1143

Experiments are reported on the masking produced by narrow bands of external origin presented alone and by the same bands presented with more intense tones. Results show that a higher-frequency tone more intense than a noise band does not increase the masking maximum produced by the noise; that masking by a pure tone and narrow noise band is not affected by the lower primary above it; that signal/masker ratios can be used to estimate combination band levels; and that weaker lower-frequency noise can affect masking by the tone.

Gruner, W. J.
IMPROVED PERCEIVED NOISE COMPUTATIONAL ALGORITHM
Acoust Soc of Amer J, v 53 n 1, Jan 1973, p 291-382

As improved algorithm for the computation of the perceived noisiness of an acoustic pressure stimulus has been developed. The algorithm is presented along with the development logic and fit criterion. Coefficient determination is achieved using a constrained least squares method. A statistical analysis of fit is presented for the derived algorithm as well as previously available methodology. The new algorithm is shown to improve accuracy from 26 percent to 36 percent depending upon amplitude and reduces computational storage requirements by 15 percent. Improved accuracy is achieved at every applicable 1/3 octave band. This algorithm was derived during psychophysiological criteria development for space shuttle system launch and static firing sites.

Hayden, R. E.
NOISE FROM INTERACTION OF FLOW WITH RIGID SURFACES: A REVIEW OF CURRENT STATUS OF PREDICTION TECHNIQUES
NASA Contract, Rep CR-2126, Oct 1972

A brief review of some fundamental aspects of sound arising from turbulent boundary layers, noise due to flow past a single discontinuity (trailing edge), noise from airfoils operating in turbulent flow, and noise due to rigid flow discontinuities (spoilers) immersed in rigid ducts is presented. Emphasis is on dipole-like sound fields associated with turbulent flow past a trailing edge. Rigid bodies in turbulence and in-duct spoilers. 27 refs.

Isermann, R.
IDENTIFIKATION DES STATISCHEN VERHALTENS STARK GESTOERTER DYNAMISCHER PROZESSF (IDENTIFICATION OF THE STATIC BEHAVIOR OF VERY NOISE DYNAMIC PROCESSES)
Regelungstech Prozess-Datenverarbeitung, v 21 n 4, Apr 1973, p 118-125

Various identification methods for the static behavior of very noisy dynamic processes are described. The scatter of the static parameter errors caused by the noise signals are compared with the minimum possible value in accordance with the Cramer-Rao-Frechet law. It is further shown how the static behavior of slow time-variant processes can be measured. Some methods can also be applied to nonlinear processes. 9 refs. In German.

Jackson, G. M.; Leventhall, H. G.
CALCULATION OF THE PERCEIVED LEVEL OF NOISE (PldB) USING STEVENS' METHOD (MARK VII)
Applied Acoust, v 6 n 1, Jan 1973, p 23-24

For noise surveys involving large amounts of data, it is often convenient to use a computer. The equal-sone contours, employed in Stevens' Mark VII method of calculating the perceived level of noise, may be represented mathematically in a form suitable for a computer program, thus reducing storage requirements needed for computing and speeding up the calculations.

Keen, K.
PRESERVATION OF CONSTANT LOUDNESS WITH INTERAURAL AMPLITUDE ASYMMETRY
J Acoust Soc Amer, v 52 n 4, part 2, Oct 1972, p 1193-1196

Intensity functions that preserve constant loudness at 70 phon under conditions of internal intensity asymmetry were plotted for pure tones, random noise, and triangular transient stimuli. The significance of the results are discussed for the design of lateralization studies.

Komissarova, N. N.
AVERAGE DECAY LAW FOR A SOUND FIELD IN A WEDGE
Sov Phys Acoust, v 19 n 2, Sept-Oct 1973, p 123-125

An average decay law is derived for the energy density of the sound field of a point harmonic source in a divergent domain having one perfectly compliant and one perfectly rigid boundary. The asymptotic representation of the field of a normal mode is used. The averaging is carried out over the angular coordinate of the source and over a certain surface in the neighborhood of the observation point. 3 refs

Lyon, R. H.
ANALYSIS OF SOUND-STRUCTURAL INTERACTION BY THEORY AND EXPERIMENT
Noise and Vibr Control Engr Conf Proc, Lafayette, Ind., July 14-16, 1971

The development and use of statistical energy analysis (SEA) in problems of sound-structural coupling are reviewed. The basic principles of SEA are stated; these include relating energy flow to modal energy differences, the relation of energy to other dynamic variables, and the statistical modeling of acoustical systems. Recent applications of SEA that relate to everyday problems of sound and vibration control are discussed. These are taken from recent work on piping noise, sound transmission through walls, and acoustics of fluid-filled containers.

Maling, G. C. Jr.; Lang, W. W.
THEORY INTO PRACTICE: A PHYSICIST'S HELPFUL VIEW OF NOISE PHENOMENA
Noise Control Engr, v 1 n 1, Summer 1973, p 45-59

The physical properties of sound are discussed as a basis for examination of problems in noise reduction. Sound waves, sound pressure, frequency, wavelength, acoustic variables, acoustic intensity and power, intensity level, sound power level, SPL, measurement of sound pressure, spectrum density, interference of sound waves, absorption coefficient, complex impedance, normal impedance of a surface, flow resistance of a porous material, and cavity resonators are examined.

Design and Barriers

Engines, Mufflers and General Practice -

Anon
ENGINEERING KNOW-HOW IN ENGINE DESIGN
SAE Spec Publ, SP-369, Mar 1972

This SAE special publication contains contributions on acoustic fundamentals, vehicle noise measurement, noise abatement, and noise control legislation. Following papers presented - Acoustic Fundamentals and Noise, J. R. Miller, p 1; Methods of Vehicle Noise Measurement, R. K. Hillquist, p 5; Noise Legislation, Present and Future , as Related to Product Design, R. H. Lincoln, p 8; The Abatement of Structural Noise in Internal Combustion Engines, R. D. Strunk, p 17; Practical Noise Control for Engines, L. F. Yerges, p 24.

Anon
NEW WAYS TO COMBAT NOISE - THE INVISIBLE POLLUTANT
Des Eng, London, June 1973, p 52-55

Noise need no longer be accepted as an unavoidable by-product of modern technology. Today, careful basic design, combined with the sound-attenuating techniques described in this article can appreciably reduce noise, and its concomitant nuesance and danger to hearing.

Lancaster, A.
MODIFYING SNOWMOBILES TO PRODUCE LOWER NOISE LEVELS
SAE Prepr 730813 for Meet Sept 10-13, 1973

The majority of snowmobiles being produced are of similar configuration and driven by a similar type of fan-cooled, two-stroke engine. These common types of snowmobiles will respond to noise control measures in a sufficiently predictable manner to permit the noise level of a modified sled to be estimated from prior experience. Conversely, for a given noise level, the required modifications may be listed which, from prior experience, will produce noise levels in the order of the selected level. The lists of modifications developed here are for target levels of 75 and 70 dBA.

Meador, C. L.; Allan III, J. J.
EXHAUST VENT MUFFLER DESIGN
ASME Paper 71-SAE-A for Meet 1971

Noise control problems exist where high pressure, high temperature gases are vented to the atmosphere. An example is used to illustrate an approach to the design of an acoustically treated expansion chamber for a typical noise problem caused by superheated steam vented to the atmopsphere. An analysis is developed to aid in the design of the acoustically treated expansion chamber type muffler for broadband frequency application. The algorithm as well as the supporting theory are sufficiently general so as to be applicable to a number of high velocity gas-generated noise conditions. An appendix of terminology definitions is included. 26 refs.

Partitions and Enclosures -

Copley, L. G.
CONTROL OF NOISE BY PARTITIONS AND ENCLOSURES
Inter-Noise 72, Intl Conf on Noise Control Engr Tutorial Papers, Washington, D.C., Oct 4-6,1972

Acoustical engineering tools available for selection and design of sound insulating structures are reviewed. Mass law and insertion and transmission loss are discussed, and conceptual forms for complete and partial enclosures, partitions, and barriers are presented.

Miller, R. R.
APPLICATIONS OF GLASS IN NOISE CONTROL
Environ Control Safety Manage, v 142 n 1, July 1971, p 18-19

Data are presented to show sound transmission class rating for various types of glass and window systems. It is shown how acoustical glass 9/32 ft thick and offering a sound transmission ration of 36 allows to work in quiet next to car assembly line, yet provides a clear view of the plant.

Phillips, W. G.; Shadley, J. R.
CURBING NOISE WITH PARTIAL ENCLOSURES
Mach Des, v 46 n 8, Apr 4, 1974, p 107-110

Meaningful relief from the racket of high speed machinery, air jets, parts conveyors, and other sources of mid-to-high frequency noise can be provided by enclosures that only partly surround the offending equipment. The trouble with such an enclosure is that its effectiveness is hard to determine before it is designed and built. A method of calculation is described which has been developed to provide 'ballpark' answers to relative effectiveness of different designs for partial enclosures, without the need to construct a model for experimental purposes. The method employs a simililfied form of statistical room acoustics. It is fully valid only when the dimensions of the enclosure are much larger than the acoustic wavelengths of interest, but this limitation rarely presents difficulties in industrial situations, where dimensions of the enclosure may be on the order of several feet and where low-frequency blasts are not the usual problem. An example is worked out to illustrate the method.

Slusser, R. A.
DESIGN AND CONSTRUCTION OF A REVERBERATION CHAMBER FOR HIGH-INTENSITY ACOUSTIC TESTING
J Acoust Soc Amer, v 53 n 5, May 1973, p 1263-1269

Theory and design considerations are given for the construction of a high-intensity acoustic test facility at the Jet Propulsion Laboratory for the Mariner Mars 1971 project. The reverberation chamber is rectangular and large enough to contain the spacecraft for test levels at 150 dB. Electropneumatic transducers were used to modulate the nitrogen atmosphere. 10 refs.

Barriers -

Butler, G.F.L
A NOTE ON IMPROVING THE ATTENUATION GIVEN BY A NOISE BARRIER
J Sound and Vibr, v 32 n 3, Feb 8, 1974, p 367-369

Some aspects of diffraction theory relevant to design and performance of noise barriers are described. Improving attenuation by an acoustic screen is suggested.

Davies, H. G.; Lyon, R. H.
NOISE PROPAGATION IN CELLULAR URBAN AND INDUSTRIAL SPACES
Acoust Soc of Amer J, v 54 n 6, Dec 1973, p 1565-1570

The effect of multiple barriers on the propagation of noise in urban and industrial environments is described by a cell model. The cell boundaries are formed by walls, machinery, etc., and each cell contains noise sources. The noise field both within and outside the source region is discussed. A comparison with the results of previous investigations shows that the cell model correctly predicts the residual background level in traffic-free zones in urban areas.

Kurze, U. J.; Anderson, G. S.
SOUND ATTENUATION BY BARRIERS
Appl Acoust, v 4 n 1, Jan 1971, p 35-53

The excess attenuation by a barrier parallel to an incoherent line source is shown to be calculable from the excess attenuation of sound emanating from a few points on the line source. Engineering estimates for the required length of an efficient barrier parallel to a line source yield an aspect angle for the barrier equal to 95 percent of the aspect angle of the line source. The sound transmission through a barrier is found to be negligible for a typical automotive traffic noise spectrum if the mass per unit area of the barrier exceeds 4LR/ft2. 16 refs.**

MacDuff, J. N.
BARRIERS FOR NOISE CONTROL
ASME Paper 73-DET-82 for Meet Sept 9-12, 1973

The experimentally determined noise attenuation of a simple barrier or partial enclosure with a stationary noise source is presented in this paper. The excitation for the experimental work was provided by a loudspeaker with either harmonic or random signal input. The output signal was filtered with a 1/3 octave filter and the attenuation taken as the difference in sound pressure level obtained with and without the barrier in place. The test results are compared with simple straight-line predictor formulas available in the literature. 13 refs.

Scholes, W. E.; Salvidge, A. C.; Sargent, J. W.
FIELD PERFORMANCE OF A NOISE BARRIER
J Sound Vibr, v 16 n 4, June 22, 1971, p 627-42

Results of a series of measurements of the performance of full-scale noise barriers of various heights, carried out under a range of wind conditions are presented. It relates to the effects of a long barrier in reducing the noise from localized sources, such as the peaks of traffic noise. 13 refs.

Equipment

Anon
POLLUTANT CONTROL EQUIPMENT. GASES, LIQUIDS, SOLIDS
Power, v 115 n 6, June 1971, p S.1-S.32

A survey of equipment now available for controlling pollution includes sections on government requirements, air pollution control, odor control, noise control, water pollution control, and solid-waste disposal.

Burger, J. F.; Van der Merwe, G.J.J.; Van Zyl, B. G.; Joffe, L.
MEASUREMENT OF SOUND INTENSITY APPLIED TO THE DETERMINATION OF RADIATED SOUND POWER
J Acoust Soc Amer, v 53 n 4, Apr 1973, p 1167-1168

Communication to the editor reports development of a system for measuring sound intensity that can also be used for measuring very low sound levels. Twelve loudspeakers provide an omnidirectional [illegible], excited by a pink-noise generator and the pressure and velocity [illegible] are fed into an analog multiplier of which the output was [illegible] by an averaging device. Initial experiments showed that intensity measurements were not significantly affected by field conditions.

Pease, A. C.
SILENCER TEST FACILITY SIMULATES NOISE SOURCE
Mech Engr, v 95 n 2, Feb 1973, p 25-29

This article describes AMF's large scale dynamic insertion loss and attenuation facility designed for two test modes--gas turbine silencers and reciprocating engine silencers. The equipment consists of a 73-in. diam centrifugal fan rated at 125,000 scfm, an electropneumatic-transducer noise source rated at 4000 acoustic watts, the necessary supply and control inputs, ducting, a flow control device, and instrumentation for measuring flow and sound pressure level. In addition to the simulated gas-turbine-engine and reciprocating engine exhaust work, tests have been in progress for some time on a simulated gas turbine intake, and a 55,000,000 Btu/hr burner has been installed on the discharge side to allow complete simulation of gas-turbine-engine and reciprocating engine exhausts using proper heat, flow, and noise inputs.

Law, Legislation, Ordinances and Attitudes

Attitudes -

Sandford, J. E.
INDUSTRY'S QUIET RUSH TO SILENCE
Iron Age, v 208 n 25, Dec 16, 1971, p 73-78

Noise control problems are considered, with particular reference to machine tool noise control. New noise specifications, admissible noise levels, responsibilities of machine tool builders and noise control methods are commented upon by numerous specialists in this field.

Vulkan, G. H.; Dallman, J. P.
THE CONTROL OF NOISE
Soc of Environ Engr, London, J 53, June 1972, p 29-32

The noise problem can be dealt with in two ways: legal remedies can be used to control noise emissions at the source, or by careful planning, the conflict between new noise sources and noise sensitive uses can in many cases be prevented before it occurs. English legal remedies are discussed according to the provisions of common law and parliamentary statutes. Planning principles dealing with highways, industrial zones, and airports discussed are based on the separation of noise producing and noise sensitive areas, the addition of any new and unavoidable noise source to an existing noisy environment rather than to a previously quiet area, and the application of sound insulation to dwellings.

Warren, M. R.; Hayley, M.; Aldon, T.
NOISE IN THE 70's. DISCUSSANTS ON DR. THIESSEN'S PAPER

The physiological and psychological effects of community and industrial noise are discussed. Ways of preventing occupational hearing loss are considered, and the effects of traffic noise on sleep patterns are examined. The effectiveness of noise control legislation is analyzed.

Laws -

Anon
MUNICIPAL CORPORATIONS: NOISE POLLUTION
Oklhoma Law Review, v 24 n 2, May 1971, p 261-266

As a source of environmental pollution, noise is not presently receiving as much attention as industrial waste or automobile exhaust, but it is a subject of growing concern. To indicate the nature and scope of the issue the law as it now stands as related to the problem of noise is examined. Whether the law provides effective means of regulation and control is analyzed.

Bragdon, C.
CITY NOISE ORDINANCES--A STATUS REPORT
Sound and Vibr, v 7 n 5, May 1973, p 45-48

A compilation is presented of municipal city noise regulations currently enacted, covering the categories of aircraft, vehicles, zoning (land use), building and nuisance. There are over 175 noise related regulations involving approximately 43 million people, which is equivalent to 23 percent of the total United States population. Nearly 85 percent or 148, of these laws contain nuisance provisions and are classified as 'nuisance type ordinances'. They typically prohibit unreasonably loud, disturbing, or unnecessary noise but neglect to define noise quantitatively. The remaining category is 'performance type ordinances'. This smaller group, incorporating acoustical criteria, are more objective in nature. These criteria include overall sound level measurements, usually expressed in decibels, on the A-weighted scale (dBA). However, many ordinances include octave band provisions in addition.

Bragdon, C. R.
CITY NOISE ORDINANCES--A STATUS REPORT
Sound and Vibr, v 7 n 12, Dec 1973, p 34-35

An update of municipal noise ordinances in the United States is presented; 288 municipalities have enacted noise regulations, representing a combined population of over 52 million people. Categories of ordinances include nuisance, zoning, vehicle, aircraft, and building. Ordinances with acoustical criteria, ordinances without acoustical criteria, and municipalities with no regulations are indicated.

Bragdon, C. R.
GUIDELINES FOR THE PREPARATION OF A MODEL NOISE ORDINANCE
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C., Oct 4-6, 1972

The provisions of a noise ordinance guideline proposed by the sectional committee on bioacoustics of the American National Standards Institute are reviewed. Surveys on hazardous and nuisance effects of noise are suggested, and environmental education is stressed. The establishment of acoustical instrumentation standards, calibration, and maintenance is recommended, along with the creation of sampling procedures for mobile and stationary sources. Acoustical criteria for standards, zoning ordinances, subdivision regulations, and site design are discussed, and enforcement techniques are summarized. The need for variances and a permit system is emphasized.

Bragdon, C. R.
MUNICIPAL NOISE ORDINANCES
Sv Sound Vibr, v 7 n 12, Dec 1973, p 16-22

A survey of the regulatory control for noise abatement, caused by vehicles and industrial plants, on a regional-local basis, is presented. The impact of programs for noise control is evaluated with respect to the quality. content and administrative problems. 24 refs.

Caccavari, C.
A NEW COMPREHENSIVE CITY NOISE ORDINANCE
Noise and Vibr Control Engr Conf Proc, Lafayette, Ind., July 14-16, 1971

A new noise ordinance went into effect July 1, 1971 in Chicago. The new regulation is unique in urban noise control in that it sets quantitative noise limits for many different major noise sources. The ordinance has retained its nuisance provisions. The main thrust of the new ordinance is directed at motor vehicles and several sections set noise standards for various types of motor driven equipment. Key sections dealing with noise limits, standards, and operations of motor vehicles: construction, industrial, and agricultural vehicles and equipment; and other powered equipment and tools are discussed.

Caccavari, C.
REGULATION AND ENVORCEMENT OF URBAN NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C.,
Oct 4-6, 1972

The provisions of Chicago's noise ordinance are discussed, and the ordinance implementation program is reviewed. Engineering activities, department organization, and enforcement measures are outlined. Vehicle and stationary source enforcement procedures are considered, and legal actions taken on complaints are examined.

Coates, V. T.
EXPERIENCE OF LOCAL AND STATE GOVERNMENTS IN CONTROL OF ENVIRONMENTAL NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C.,
Oct 4-6, 1972

The regulatory structure for noise control at state and local levels is outlined, with emphasis on the general effectiveness of noise control legislation. Experiences in New York, California, and Hawaii are cited. States have been ineffective in controlling vehicle and aircraft noise because of technical, legal, and financial constraints. City ordinances are vague and technically deficient, and cities are hampered by more urgent urban problems, lack of enforcement authority, and budgetary difficulties. Local governments have also been ineffective in dealing with noise. Courts have become more involved in noise controversies, but private suits for compensation have not brought about a great deal of noise suppression. Federal Government standards for control at the source appear to be the most effective approach to noise control; the use of comprehensive local noise ordinances with quantified limits that would be enforced by municipal agencies is suggested.

Crocker, M. J.
NOISE CONTROL IN BRITAIN AND OTHER EUROPEAN COUNTRIES
Noise in the Environment; Causes, Effects, Controls, Conf Papers,
Toronto, Ontario, Canada, April 28-29, 1971

Britain's efforts to reduce noise from aircraft, traffic, airports, industry, and buildings are cited. Limitations on motor vehicles noise are reported, and enforcement procedures are discussed. British regulation of aircraft noise is similar to United States regulation. The noise abatement act is concerned with noise in residential districts near industrial plants, but there is no statutory law regarding noise within an industrial plant.

Flanagan, W.
LEGAL NOISE LIMITS DEMAND IMPROVED ENGINES AND SUBSYSTEMS
SAE J Automot Engr, v 80 n 5, May 1972, p 36-41

This paper reviews current legislative standards for noise levels on devices ranging from snowmobiles and chainsaws to trucks. Current practices in each field are noted and areas for continued research are suggested.

Gatley, W. S.; Frye, E. E.
REGULATION OF NOISE IN URBAN AREAS
Regulation of Noise in Urban Areas, First Ed., Manual, Univ of Mo., Continuing Educa Series, Rolla, Aug 1971

Information about the characteristics of noise, its measurement and evaluation, and current trends in noise legislation and standards is provided. The following topics are discussed: noise legislation, fundamentals of sound and acoustic terminology, criteria for rating sounds, the character of urban noise, the noise nuisance ordinance, municipal noise ordinances, regulation of vehicle noise, regulation of airport/aircraft noise, characteristics and regulation of occupational noise, comprehensive noise ordinance of the City of Chicago, proposed airport zoning ordinance and building code, industrial association noise measurement procedures and standards, and requirements for control of urban noise through regulation and planning.

Harmsen, S. M.
ONE CITY'S ANSWER TO NOISE POLLUTION
Waste Age, v 4 n 5, Sept-Oct 1973, p 70-71

On Aug 17, 1972, the Salt Lake City Commission passed one of the most stringent antinoise ordinances in the country. The ordinance sets forth noise limits (measured in decibels) for various areas in the city, as well as times when the noise level must be reduced. The ordinance places restrictions on horns, signaling devices, hawkers, peddlers, animals, fowl, steam or air whistles, loading, unloading, construction or repair of buildings, pile drivers, hammers, garbage collections, vehicle repairs, exhausts, and other loud, unnecessary or unusual noises. Various departments of the Salt Lake City Government set examples to the people of Salt Lake City as to how to control noise, one example being a refuse collection vehicle with a noise suppressing device.

Jensen, P.
CONTROL OF ENVIRONMENTAL NOISE.
J Air Pollut Control Assoc, v 23 n 12, Dec 1973, p 1028-1034

The article reviews the current state of knowledge of noise and how people respond to noise. Sources of community noise are discussed and existing federal legislation pertaining to noise is mentioned. Method of reducing the noise impact on communities from aircraft, surface transportation, and industrial sites are presented. 14 refs.

Karplus, H. B.
NOISE CONTROL THROUGH LEGISLATION
Noise and Vibr Control Engr Conf Proc, Lafayette, Ind., July 14-16, 1971

While Federal legislation exists to protect employees from hazardous hearing environments in industrial plants, the control of annoying noise in urban areas is usually covered by city ordinances. These "disturbances" and "annoyance" regulations vary widely and are based on both zoning and noise levels. A major problem exists due to the different measures for evaluating noise. Noise legislation adopted by several cities in the United States is discussed.

Kodaras, M. J.
NOISE CONTROL AND THE N.Y.C. BUILDING CODE, 1962-1972
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Washington, D.C.
Oct 4-6, 1972

Restrictions on all potential intrusions of noise into a multiple dwelling building incorporated in the New York City Building Code are reported. The restrictions do not apply to plumbing noise or to office buildings and commercial structures. Minimum standards for noise from boilers, elevators, rubbish chutes, mechanical equipment, and air ducts are established. Enforcement of these restrictions is discussed.

Lehtinen, P. U.
THE CONQUEST OF NOISE IN FINLAND
Noise 2000. Assn Intl Contre Le Bruit. Intl Cong 5th & 6th, London, May
1968 and Groningen Neth. May 1970

Noise reduction legislation in Finland is briefly reviewed. The 1958 Finnish law on safety in work considers occupational health and noise abatement in industry. In 1966, the Finnish Council for Air Conservation and Noise Abatement was appointed; the Council is responsible for dealing with general problems concerning air pollution and noise abatement. Conservation of nature in 1970 created several committees for the planning of how to increase the efficiency of noise legislation.

MacNeill, J. W.; Cummings, T.; Mastromatteo, E.; Hambling, D.; Lewis, P.
LEGISLATION AND ADMINISTRATION FOR NOISE CONTROL
Noise in the Environment; Causes, Effects, Controls, Conf Papers,
Toronto, Ont., Can., April 28-29, 1971

The roles of Canadian Federal, Provincial, and Municipal Governments and the private citizen in noise control are discussed. Legislation, research programs, guidelines, and standards for community, aircraft, and industrial noise are reported. Enforcement of noise control laws is considered.

Moore, J. S.
DEVELOPING A STATE-WIDE NOISE CONTROL PROGRAM--THE ILLINOIS EXPERIENCE
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

The provisions of the Environmental Protection Act of 1970 are reviewed, and the duties of the Illinois Pollution Control Board, the Illinois Environmental Protection Agency, and the Illinois Institute for Environmental Control are discussed. The Illinois Pollution Control Board is a quasi-judicial body which considers enforcement cases, variance petitions, and permit appeals. The agency also issues orders and sets penalties after open public hearings and adopts environmental quality standards and regulations. The Illinois Institute for Environmental Quality is chiefly involved in research. The Illinois Environmental Protection Agency conducts surveillance activities, issues permits, administers antipollution bond acts, prepares environmental quality management plans, and recommends action on variance requests. The role of the Illinois Attorney General's Office is outlined, and hearings that have been conducted on various environmental issues are examined.

Taylor, R.
NOISE LEGISLATION IN BRITAIN
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

The weaknesses of Britain's Noise Abatement Act are discussed, and alternative methods for dealing with noise control are proposed. Most of Britain's statutory legislation is inadequate and needs strengthening. In addition, there is a complete lack of laws concerned with hearing damage. At present, the most effective manner of dealing with noise nuisance is applying to the high court for an injunction.

Smith, W. A.
NOISE CONTROL LEGISLATION
Air Pollut Control Assoc, J, v 23 n 4, Apr 1973, p 251-256

The EPA is expected to issue its recommendations on noise legislation some time during the latter part of 1973. This agency will assume primary responsibility for enforcing noise limits on new products, such as vehicles, construction equipment, and electrical equipment. Primary responsibility for community noise control will remain with local governments. State and local agencies, now involved in air and water pollution, will be given the additional responsibility to enforce antinoise legislation. This legislation will cover noise emissions from vehicles, industries, construction equipment, residential air conditioners, and power equipment, and the noises that pervade multifamily dwellings. Responsibility for controlling aircraft noise will be shared with the FAA. The noise ratings used in this legislation must be capable of easy measurement and yet correlate well with subjective response. For most noises the dcibel level read on the A-scale of a sound level meter is adequate. Aircraft noise and industrial-construction noises need special consideration. New community noise ordinances will draw on the research and experience associated with the present Chicago, Illinois ordinance. Some modifications of this ordinance are expected, however, to improve enforcement procedures and to lower vehicle noise levels, which are considered the worst of all the community noise pollutants.

Wesler, J. E.
NOISE LEGISLATION AND ORDINANCES
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap (Wash, D. C., Oct 4-6, 1972)

Federal, state, and local noise control regulations are reviewed. Federal regulations concerned with noise from aircraft, highway, housing, industry, and environment are described, along with legislation passed by Hawaii, California, New York, Colorado, Minnesota, Chicago, Boston, and New York City. Most state laws are general in nature and establish environmental agencies, but some specific noise control laws have been enacted. Cities and communities usually have general subjective standards for noise control based on public nuisance and zoning criteria.

Standards -

Murphy, J. N.; Sacks, H. K.; Durkin, J.; Summers, C. R.
PROGRESS IN NOISE ABATEMENT
Amer Mining Congress, 1972 Coal Show, Pap, (Cleveland, Ohio, May 8-11, 1972)

The mandatory noise standards developed in respone to the Coal Mine Health and Safety Act of 1969 specify maximum personnel noise level-time exposure for underground coal mines. The act further specifies that personal protective devices shall not be used to meet the standards where the protective devices may otherwise impair the safety of a miner; this specifically refers to the use of earmuffs or plugs that would impair the ability to hear warning signals in the mine. A personal audio dosimeter developed to assess an individual's exposure to intermediate vs multiple coal mine noise is described. A discriminating earmuff which in the absence of noise allows the wearer to hear low-level warning signals is also discussed, as is the development of noise abatement and control techniques for underground noise sources, particularly pneumatic drills.

Nowikas, W. M.
NOISE OF SOUND
Amer Mach, v 116 n 25, Dec 11, 1972, p 61-68

OSHA requirements, noise level curves and methods for computing loudness are discussed. Sound levels can be reduced by proper design and installation of acoustical materials, vibration isolators, mufflers, damping techniques and barriers.

Tyler, J. M.; Hinton, L. V.; Olin, J. G.
STATE STANDARDS, REGULATIONS, AND RESPONSIBILITIES IN NOISE POLLUTION CONTROL
J Air Pollut Control Assoc, v 24 n 2, Feb 1974, p 130-135

Comprehensive noise standards are presented for all sources of noise, including airports, highways, and industrial sources. The dimensions of noise intensity and frequency are measured by the use of the unit dBA, whereas the duration is measured by use of the temporal distribution. Aircraft noise and impulse noise standards are discussed together with the six phase implementation plan for noise abatement.

Discussions of Standards -

Baron, R. A.
THE CITIZEN RESPONSE TO NOISE SINCE 1967
Acoust Society of Amer, J, v 53 n 1, Jan 1973, p 291-392

Since 1967, the citizen has been on the offensive, he has learned how to intensify awareness of noise pollution. His educational techniques have become more sophisticated. Pressure points have been discovered and are being applied. Environmental noise is now being recognized by some acousticians and polluters. However, significant moves toward abatement have yet to be taken. While the hearing loss aspect of occupational noise is now being recognized in legislation, the nonauditory aspects are totally neglected. The citizen is, therefore, now including a concern for occupational noise while intensifying his battle against environmental noise exposure. The noise receiver is still asking the acoustician to move from measurement for the protection of vested interests to abatement for the sake of human interests.

Baxa, D. E.
NOISE LEGISLATION AND ITS IMPLICATIONS TO INDUSTRY
SAE Prepr n 730435 for meet, Apr 2-4, 1973

This paper considers the historic cases and laws in the United States which have had and will have the effect of bringing quiet to the citizens of this country. The legal developments included are, Wisconsin's Occupational Hearing Loss Compensation law, the Walsh-Healey Act, Occupational Safety and Health Act, the Chicago Noise Ordinance, and the

Noise Control Act of 1972. A review of the standards presented by each piece of legislation will be given, and their effects on both industry and its products will be pointed out. 11 refs.

Bryan, M. E.; Tempest, W.
ARE OUR NOISE LAWS ADEQUATE?
Appl Acoust, v 6 n 3, July 1973, p 219-232

British laws and regulations aimed at controlling excessive noise appear to be based on the assumption that everyone reacts in a similar manner when exposed to noise. The criteria are concerned with what level of noise exposure is likely to annoy the average person. Ways that individuals react to noise were examined, but the concept of the average person was relatively meaningless. The criteria for noise control are inadequate because they do not provide the protection intended. Not only is there a wide spread in the degree of annoyance due to noise, but also the population shows inhomogeneity in the nature of its response. Some people learn to live with the noise and gradually adapt to it, and others become progressively more disturbed by it. In some circumstances, factors relating to the individual can be more valuable in predicting the response to noise than is the nature of the noise itself. For adequate protection of the individual against annoying noise, the personality and personal factors of the individual must also be studied.

Howe, J. T.
A BALANCED APPROACH--A LAWYER'S VIEWPOINT
Intl Conf on Transportation and the Environment, (Wash, D. C., May 31-June 2, 1972)

Laws controlling noise and the role of government agencies must be balanced against their interests, limitations of technology, and environmental goals. Past attempts to control noise sustain the need for a balanced approach. Realistic, uniform standards enforced by realistic, uniform procedures will advance the cause of noise control; inconsistent standards and enforcement procedures will impede effective noise control.

Kryter, K. D.
ACOUSTICAL SOCIETY OF AMERICA POLICY ON NOISE STANDARDS
J Acoust Soc Amer, v 51 n 3 pt 1, Mar 1972, p 803-806

The standards role of the Acoustical Society of America, as related to noise, is reviewed in the light of the recommendations of the ad hoc committee on policy and requirements of the Arden House Conference on Standards, July 1971.

Mayo, L. H.; Ware, R. C.
THE EVOLVING REGULATORY STRUCTURE OF ENVIRONMENTAL NOISE ABATEMENT AND CONTROL
Inst of Environmental Sciences Annu Tech Meeting, 18th, Proc, (New York, New York, May 1-4, 1972), p 226-234

The evolution of laws and regulatory structures to control environmental noise are discussed. Sources, regulatory efforts, and trends in the private sector, and at the local, state, and federal levels are investigated.

Meyer, A. F.
NEED FOR STANDARDS ON NOISE
J Acoust Soc Amer, v 51 n 3 pt 1, Mar 1972, p 800-802

The noise problem is reviewed from the viewpoint of environmental pollution. Regulation of noise by government at every level demands setting up of standards that account not only for scientific criteria but also for economic, sociological, and political considerations.

Newell, P. H., Jr; Sherwood, A. M.; Wilson, A. B., Jr; McDaniel, G. L.
TOWARD ACOUSTIC STANDARDS FOR POWERED ASSIST DEVICES
S Veterans Administration Department of Medical Surgery, Bull Prosth Res, n 10-17, 1972, p 21-32

Externally powered prosthetic devices in current use are unacceptably noisy. The objectives of this paper are: 1. to move toward a rational basis for setting noise level standards, 2. to distinguish between short-term goals and longer range standards for noise levels, and 3. to identify conventional techniques and methods for reducing or eliminating such noise. In order to accomplish these objectives and to provide a concise reference for manufacturers, a brief review of the theory of sound is also presented. 12 refs.

Rupert, H. M.; Wesler, J. E.
THE MAKING OF A NOISE CONTROL REGULATION
Sound and Vibr, v 7 n 10, Oct 1973, p 34-35

The historical background, the general intent, and the content of the Federal Highway Administration's highway design noise level standards (1973) are reviewed. Information is provided on preparation of the standards and follow-up activities. Development and promulgation of a federal policy or regulation is not a quick or easy procedure, particularly when environmental issues are at stake. A balance must be found between environmental protection and the need to provide a safe and efficient transportation.

Criteria -

Evaluation and Use -

Constance, J. D.
NOISE CRITERIA: THEIR EVALUATION AND USE
Consulting Engr, (St. Joseph, Mich), v 41 n 6, Dec 1973, p 58-63

Sound basics, the decibel scale, single number rating system, A-scale weighting network, noise criteria by the tangent contour method, effect of equal decibel levels, prediction of the noise criteria values of equipment sounds, and sound control criteria for industrial buildings are discussed.

Tempest, W.
LOUDNESS AND ANNOYANCE DUE TO LOW FREQUENCY SOUND
Acustica, v 29 n 4, Oct 1973, p 205-209

Examples are provided of noise spectra which have produced annoyance and other adverse reactions to a greater extent than would be expected using the normal criteria based on dBA or phons. In all cases the noise spectrum had high energy levels in the octave bands below 100 Hz. It is suggested that noise spectra of this type cause annoyance, unease and disturbance to an extent not simply related to loudness, and that in these circumstances the common assumption that annoyance and loudness are equivalent breaks down. A need for further research in this field is pointed out. 4 refs.

Trends and Level -

Gatley, W. S.
CURRENT TRENDS IN CONTROL OF URBAN NOISE
ASME Pap n 72-PEM-9 for Meeting Oct 15-18, 1972

Physical characteristics of noise, as well as basic definitions and terminology, are reviewed. Several criteria for evaluating subjective response to community noise are presented. Typical and recommended noise levels in residential, commercial and industrial areas, and representative levels from common noise sources, are summarized, guidelines for fair and effective control of urban noise by regulation are recommended. Various types of regulations, and a comprehensive program for regulation of urban noise, are described. 7 refs.

Hirschorn, M.
NOISE LEVEL CRITERIA AND METHODS OF ENGINEERING NOISE CONTROL
Ind Acoust Co, Bronx, N. Y., IAC Bulletin 6.0010.0, 1973

Industrial noise level criteria are discussed as they relate to audiometric testing, hearing conservation, speech communication, and municipal zoning. This provides a basis for understanding the engineering of noise control. Octave band SPLs are examined in relation to the noise exposure standards in Occupational Safety Health Act. Equivalent octave band noise design guide-levels, ranging from 70 to 115 dBA are given in tables and graphs for engineering design purposes. The availability and application of a wide range of modular, acoustically rated components and preassembled acoustic structures are reviewed. These include: prefabricated sound-proof rooms, prefabricated offices and work stations, and intake and exhaust silencers. Examples are given showing how these have been applied to meet noise level criteria.

Quality and Economic Factors -

Goldstein, S. N.
PROTOTYPE INDEX FOR ENVIRONMENTAL NOISE QUALITY
SV, Sound Vibr, v 6 n 2, Feb 1972, p 30-33

A prototype technical standard for environmental noise is proposed in terms of enabling an index of noise quality to be defined and calculated. The standard takes into account the damaging aspects of chronic exposure to loud noise as well as psychologically disturbing aspects of typical community noises which are not loud enough to be physically dangerous. Inasmuch as the standard is intended to portray environmental quality rather than to reflect damage risk criteria, it is generally conservative with respect to work-related noise standards, such as those specified by the Walsh-Healey Act. 2 refs.

Pelton, H.
CONTROL OF NOISE BY BALANCING ENGINEERING AND ECONOMIC FACTORS
ASME Pap n 72-PEM-17 for Meeting Oct 15-18, 1972

The standard techniques of noise control engineering are examined in addition to the economics of utilizing these techniques. The approach is to consider various noise control methods for a particular example, then examine the advantages and disadvantages of each method on the basis of the magnitude of the noise and its frequency distribution, the criteria, the type of environment and the associated maintenance and productive problems. 7 refs.

Frequency Analysis -

Goulet, P.; Northwood, T. D.
SUBJECTIVE RATING OF BROADBAND NOISES CONTAINING PURE TONES
Acoust Society of Amer, J, v 53 n 1, Jan 1973, p 291-392

For rating the noise of broadband sources the custom is to utilize A-weighted levels, but there is no consensus on the subjective importance of pure-tone components that may be present. Some direct evidence was sought by having each of nine subjects match pairs of noises by adjusting the level of one of them. Two experiments used a modified random noise to which a pure tone in the range of 250-2,000 Hz could be added. The first experiment involved a simple comparison in a quiet environment. The second experiment involved similar noises but with the addition of a local wanted sound in the form of music, and the subject matched noises from the viewponit of intrusiveness. A third experiment was similar to the first but utilized actual machine noise as the basic spectra. All three experiments indicated that the A-weighted level remains an adequate (slightly conservative) rating number even when pure tones are present.

Phelps, A. H.
NEED FOR FREQUENCY ANALYSIS IN THE IDENTIFICATION AND SOLUTION OF NOISE PROBLEMS
J Air Pollut Control Assoc, v 23 n 1, Jan 1973, p 17-22

Proposed noise criteria for neighborhoods which reflect the effect of frequency are discussed along with one noise regulation in force that avoids the problem of a single decibel level specification. Some case histories are presented and compared with the criteria.

Technical Notes -

Miscellaneous Subjects -

Beranek, L. L. (ed)
NOISE AND VIBRATION CONTROL
Noise and Vibration Control, McGraw-Hill Book Co, New York, 1971

Three principal aspects to consider in a project for noise control (source, path, and receiver) are delineated, including how noise sources radiate, their directional properties, their character, and how to measure and rate them. Practical design and regulatory information such as formulas, choice of materials and structures, city codes, and hearing protection are emphasized. Included are: the fundamentals of sound in free space, outdoors, and in small enclosures or rooms; an understanding of decibels; the methods for measuring and analyzing noise and vibration; methods for selecting design criteria; and methods for choosing materials, structures, mufflers, and vibration isolators to quiet a product or building.

Lowery, R. L.
NOISE CONTROL: A COMMON-SENSE APPROACH
Mech Engr, v 95 n 6, June 1973, p 26-31

This article presents a very practical and pragmatic view of some noise-control techniques that should be useful in many commonly encountered noise problems. Although some noise problems require the attention of a highly trained specialist, many machinery problems can be solved by a few relatively simple common-sense procedures. A simplified method of attack might read as follows: get rid of the machine or turn it off;

make it quit vibrating by damping surfaces; cut the energy-transmission path by isolation or by placing the machine in an enclosure; change the directivity pattern by the use of barriers. This is especially effective at the high frequencies produced by jets and other fluid noises; as a last resort, apply sound-absorbing material in the surrounding area. Many machinery noise problems, however, are of a very complex nature and will not yield to simple cures. There is no substitute for proper design; ultimately all noise problems will have to be solved by the persons who design the machinery and not by acoustical consultants. It is far easier for a skilled design or plant engineer to become conversant with noise-control practice and terminology than it is for many acoustical consultants to become adept at design work.

Robinson, D. W.
AN ESSAY IN THE COMPARISON OF ENVIRONMENTAL NOISE MEASURES AND PROSPECTS FOR A UNIFIED SYSTEM
Teddinton, Eng, Natl Physical Laboratory, Acoust Rep AC 59, Oct 1972

The complications and uncertainties which arise when attempting to compare the significance of numerical values in incompatible scales of noise assessment are illustrated with a specific example. Traffic noise at an A-weighted sound level of 70 on the L_{10} (noise level exceeded for 10 percent of the time) scale is shown to be equivalent to industrial noise of about 74 dBA rated by the corrected noise level according to British standard 4142, for corresponding periods of time. The translation is subject to a large uncertainty ($\pm$ 13 dB) and highlights the desirability of adopting a common scale of measurement. The status of noise pollution level as a solution to this problem is reviewed. Some of its limitations are discussed and ways are shown in which these could be overcome. A criterion is put forward by which the inevitable complications of a more general measuring scale may be balanced against the gain in precision over the existing formulation of the noise pollution level.

Sharland, I.
WOODS PRACTICAL GUIDE TO NOISE CONTROL
Woods Practial Guide to Noise Control, Woods of Colchester Limited, Eng, May 1972

Noise and noise pollution are examined. How to establish noise levels in industrial, commercial, and domestic environments is demonstrated. Determining the amount of noise reduction and how to specify optimum levels of attenuation are also discussed. Strong emphasis is placed on the methods of analyzing noise and its transmission.

Sprinkle, M. C.
ACOUSTICS FOR AUDIO MEN-1
DB, Sound Engr, v 5 n 3, Mar 1971 p 21-23

The rudiments of acoustics and sound transmission are presented. A few of the fundamentals of sound are discussed. How sound travels and is transmitted, both indoor and outdoor, is studied.

Weber, B. H.; Cooke, J. S.; Borland, R. M.; Watt, A.; Allen, G. A.; Perry, R. J.; Laing, R.
WHAT PRICE HEALTH, SAFETY?
Can Min J, v 93 n 9, Sept 1972, p 26-80

Following is part 2 of the list of titles and authors. Noise Suppression on Rock Drills, by B. H. Weber. Enclosures Shut Out Noise for Hoistmen, by M. C. Kossatz. Noise Sources Traced - Abatement Achieved, by J. S. Cooke. Buyers Asked For And Got Noise Suppression in Trucks, by R. M. Borland. Noise Suppression at Grinding Mills, by A. Watt. Attack, Not Protection - Manager's Role in Drug Control, by G. A. Allen. Alcoholic Easy to Spot if Supervisor is Looking, by R. J. Perry. Drug Scene: Bad Trip in Mines, by R. Laing.

Young, T. C.
NOISE ABATEMENT--A BALANCED APPROACH
Society of Automotive Engr, J Automotive Engr, v 80 n 7, July 1972, p 76

Concern over noise emissions has increased significantly. The noise emission problem is related to other pollution efforts, and alternative abatement strategies are defined. Major technical and economic parameters are discussed, based on the present state-of-the-art. A balanced approach to noise abatement is suggested.

Glossary -

Cheremisinoff, P. N.,; Cheremisinoff, N. P.
POLLUTION ENGINEERING NOISE GLOSSARY
Pollut Engr, v 5 n 5, May 1973, p 26-31

A quick reference for the most common terms associated with noise work in industry was compiled. When possible, definitions were generalized so as not to preclude the different specific interpretations which may be attached to the term in particular applications; the greatest emphasis is given to engineering application. The glossary is divided into three sections covering general terms and definitions, terminology pertaining to noise-reducing techniques and sound-measuring devices; and mathematical definitions and acoustical measuring units and related measuring techniques.

Measurement -

Insulation -

Lang, J.
DIFFERENCES BETWEEN ACOUSTICAL INSULATION PROPERTIES MEASURED IN THE LABORATORY AND RESULTS OF MEASUREMENTS IN SITU
Appl Acoust, v 5 n 1, Jan 1972, p 21-37

The writer examines all the causes of variations in insulation properties measured in the laboratory and in the field, i.e. connections, locations, flanking walls, doors, windows, equipment and workmanship. 46 refs.

Jain, R. K.; Mulholland, K. A.
A DATABANK OF SOUND INSULATION MEASUREMENTS
Appl Acoust, v 6 n 2, Apr 1973, p 133-141

An acoustic data bank of sound insulation measurements is being compiled at the University of Liverpool. The necessity for and advantages of such a data bank are discussed. The formation of the entries in the bank is discussed and classified under established concepts. The coding and the purpose of the parameters selected for the compilation of the data bank are explained, and the uses intended for the data bank are given. The data bank is expected to benefit the building industry as a whole, as well as research workers engaged in related problems.

Sound Fields -

Galanenko, V. B.; Karnovskii, M. I.; Rasnyi, L. G.
MEASUREMENT OF THE PROBABILISTIC CHARACTERISTICS OF RANDOM SOUND FIELDS
Sov Phys, Acoust, v 19 n 2, Sept-Oct 1973, p 103-105

A method is proposed for enhancing the accuracy of measurements of the probabilistic characteristics of random sound fields, and optimum algorithms are determined for measurement of the corresponding characteristics. 4 refs.

Rudgers, A. J.
DETERMINATION OF THE FARFIELD RADIATION OF A NOISE SOURCE FROM NEARFIELD MEASUREMENTS MADE WITH A TROTT ARRAY
J Acoust Soc Amer, v 53 n 5, May 1973, p 1411-1416

A theoretical development shows that a Trott nearfield array can be used to measure the farfield-radiation characteristics of a finite source radiating partially coherent noise. The method utilizes the mutual-coherence function of the noise field to provide a complete description of the radiated noise.

Community Noise -

Fisk, D. J.; Salvidge, A. C.; Sargent, J.
DATA LOGGING TECHNIQUES FOR TWENTY-FOUR HOUR NOISE MEASUREMENT
Appl Acoust, v 6 n 4, Oct 1973, p 315-318

A data logging system is described which has been used successfully in monitoring traffic noise for 24 hours. This system is compact, quiet, and enables a rapid processing of field data. It produces detailed and accurate statistical analysis of noise, is portable, fully automatic and easy to set up. It has a low manpower requirement. This system is intended for use in a forthcoming BRS social survey. 2 refs.

Schultz, T. J.
SOME SOURCES OF ERROR IN COMMUNITY NOISE MEASUREMENT
SV, Sound Vibr, v 6 n 2, Feb 1972, p 18-27

Statistical analyses of the fluctuating levels of community noise are time-consuming and expensive procedures. In order to economize on time and money, some short-cut methods have been proposed, such as the consideration of A-weighted sound only, the reduction of the observation period, or the use of less complicated equipment than statistical analysis gear. The article considers errors that may result from several such methods. 28 refs.

Transmission Loss -

Schomer, P. D.
MEASUREMENT SOUND TRANSMISSION LOSS BY COMBINING CORRELATION AND FOURIER TECHNIQUES
J Acoust Soc Amer, v 51 n 4 pt 1, Apr 1972, p 1127-1141

The feasibility is demonstrated for performing transmission loss and diffraction measurements using correlation techniques that directly yield the responses due to signals transmitted through and around acoustic barriers. Noise signals are first cross-correlated, the Fourier transform then found for the resulting impulse response, and corrections made for source imperfections in the frequency domain. Comparative measurements are cited for common materials.

Whatmore, A. R.; Lowson, M. V.
SIMPLE SOUND TRANSMISSION LOSS MEASUREMENT USING A MODIFIED IMPEDANCE TUBE TECHNIQUE
Appl Acoust, v 6 n 4, Oct 1973, p 293-300

A method of comparing the sound transmission characteristics of various materials, and combinations of materials, is presented, using a modified impedance tube technique. The procedure proved to be relatively quick and inexpensive in comparison with standard reverberation suite tests, and is therefore particularly useful for the qualitative ranking of multiple samples. The limitations of the technique are discussed in some detail, and particular emphasis is given to the problems of small sample size and method of mounting in the apparatus. 4 refs.

Reverberent Chamber -

Baade, P. K.
EQUIPMENT SOUND POWER MEASUREMENTS IN REVERBERATION ROOMS
J Sound Vibr, v 16 n 1, May 8, 1971, p 131-135

The problems of practical measurements of equipment sound power in reverberation rooms are identified and reviewed. The results of recent fundamental work, both theoretical and experimental, give clear indications of the accuracy that can be achieved in these measurements. 11 refs.

Cyphers, H. D.; Munson, A. N.; On, F. J.
COMPARATIVE EVALUATION OF PREDICTED AND MEASURED PERFORMANCE OF A 68M**3 TRUNCATED REVERBERANT NOISE CHAMBER
NASA Special Publication 366 for Conf, Space Simulation, 7th (Los Angeles, Calif, Nov 12-14, 1973) p 127-153

The performance of a medium size, truncated reverberation chamber is evaluated in detail. Chamber performance parameters are predicted, using classical acoustic theory, and compared with results from actual chamber measurements. Discrepancies are discussed in relation to several available empirical corrections developed by other researchers. Of more practical interest is the confirmation of a recent theory stating that the present rule of thumb for the ratio of specimen volume to test chamber volume, approximately 10 percent, is overly conservative and can be increased by a factor of at least two and possibly three. Results and theoretical justification of these findings are presented. 8 refs.

Ebbing, C. E.
EXPERIMENTAL EVALUATION OF MOVING SOUND DIFFUSERS FOR REVERBERANT ROOMS
J Sound Vibr, v 16 n 1, May 8, 1971, p 99-118

One of the first known uses of rotating sound diffusers was by Wallace Clement Sabine. The two points that Sabine makes, which are very pertinent to all reverberant room sound testing involving discrete frequency sound sources, are use of the diffusing vane to provide a more uniform coupling between the test object and the sound field in the room: use of a diffusing vane to aid in the determination of the space-time average sound pressure throughout the room.

Slusser, R.; Marrone, J.
INVESTIGATION INTO THE TECHNIQUES OF REVERBERATION TIME MEASUREMENT
Audio Engr Society, Conv, 45th, Prepr of Pap, (New York, N. Y., May 15-18, 1973) n 907 (C-2), 1973

Various methods for measuring reverberation time are tested using a source of known decay time. Both random noise and sine signals are used. Methods include using a storage oscilloscope, a level recorder, and a real-time analyzer and X-Y recorder. Special equipment was not used, as occasional measurement could not justify the expense. Particular emphasis was placed on long reverberation times as found in reverberation chambers.

Miscellaneous -

Cassot, F.; Extremet, G. P.
DETERMINATION NUMERIQUE DU CHAMP SONORE ET DES FREQUENCES PROPRES DANS UNE ENCEINTE CIRCULAIRE PAR LA METHODE DE DISCRETISATION (NUMERICAL DETERMINATION OF THE SOUND FIELD AND OF THE CHARACTERISTIC FREQUENCY IN A CIRCULAR ENCLOSURE BY THE METHOD OF DISCRETIZATION)

Deruyter, R. L.
DEVELOPMENT OF SOUND LEVEL MEASUREMENT PROCEDURE FOR SMALL ENGINE POWERED EQUIPMENT
SAE Prepr n 730812 for Meet, Sept 10-13, 1973

The paper describes work of the SAE small engine powered equipment subcommittee in the development of a new sound level measurement procedure for small engine powered equipment. Data were gathered in an effort to improve the test site used in the measurement of exterior sound level of small engine powered equipment such as mowers, riding mowers, garden tractors, snowblowers, etc. A procedure was developed with a shorter measurement distance and an artificial test surface. The new procedure provides accurate, repeatable sound level data.

Flintoff, J. L.
ANSTY NOISE FACILITY, ITS DESIGN, INSTRUMENTATION AND FUTURE COMMITMENTS
AERON J, v 75 n 726, June 1971, p 397-406

This paper presents a description of the anechoic chamber and its absorption characteristics, together with a discussion of the power drive and test control system. The noise recording technique and the real time narrow band noise analysis system are also considered. Illustrations are made of subsonic and supersonic fan noise together with an interpretation of the buzz saw phenomenon. The possible use of the new plant to investigate boundary layer control and the employment of passive and reactive acoustic absorbers in the duct walls are considered. 10 refs.

Foti, M.; Lucet, P.
DEVELOPMENT TECHNIQUE, BRUIT ET REGLEMENTATION (TECHNICAL EVOLUTION IN THE FIELD OF NOISE AND NOISE CONTROL)
Ingenieursblad, v 42 n 5, Mar 1, 1973, p 118-128

The main principles of sound and noise perception and measurement are briefly reviewed, followed by a detailed discussion of the basic aspects of noise control. For illustration, examples are given of the special fields of noise occurrence which are subject to regulation measures in France, such as on construction sites, in traffic, and air transportation. 43 refs. In French.

Haering, H. U.; Schulz, C.
EXPERIENCE WITH THE NEW METHODS OF MEASURING AND ASSESSING NOISE (ERFAHRUNGEN MIT DEN NEUEN METHODEN DER GERAEUSCHMESSUNG UND -BEURTEILUNG)
Stahl Eisen, v 91 n 9, Apr 29, 1971, p 502-508

On the basis of practical experience and the results of investigations, the adequacy of noise measurements made according to prescribed methods is critically discussed. Difficulties in using the measurements in attempts to lower noise levels are described. Suggestions are made for possible improvement. 20 refs. In German.

Hirsh, I. J.
NOISE AND MAN
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap, (Wash, D. C., Oct 4-6, 1972) p 8-11

Assessment of noise effects includes measurement of magnitude of sensation; interference with speech communication; and physiological and general negative reactions (including annoyance). Single measurements in which the spectrum is weighted and an indicator gives a reading at any particular instant in time are possible; a recording instrument can also show how the level varies in time. In addition, the spectrum can be analyzed band by band, enabling measurements to be reported in different parts of the spectrum either for an instant, averaged over a long time, or as a function of time.

Ishii, Y.; Ishida, M.
APPLICATION OF CROSS-SPECTRAL ANALYSIS TO THE MEASUREMENT OF CONTRIBUTION OF NOISE SOURCES
Inst Space Aeronaut Sci, Univ Tokyo, Rep n 493, May 1973, p 41-48

The measurement of the contributions of noise sources is performed to determine the amount of acoustic power contributed to the field at a given point by each of several sources. The signal from the microphone placed at an observation point is cross-correlated with the signal from the second microphone placed sufficiently close to a noise source. The measured cross-correlation function is converted into the cross-spectral density through digital computations and then divided by the power-spectrum of the signal from the second microphone, giving the frequency transfer function between the noise source and observation point. Using the computed transfer function, the component due to the source in question can be separated from total sound power-spectrum at the observation point.

Mohr, J. W.
EXTERIOR SOUND LEVEL MEASUREMENT PROCEDURE FOR PLEASURE MOTORBOATS
SAE Prepr n 730811 for Meet, Sept 10-13, 1973

The paper describes how the SAE marine sound level committee, and representatives of the boating industry, developed a procedure for the standardized measurement of maximum "pass-by" sound levels for pleasure motorboats up to 65 ft in length. Sound level data for typical boats are presented, as well as the reasons for the procedure and the justification for the tolerances used. The committee's activity resulted in SAE recommended practice J34, Exterior Sound Level Measurement Procedure For Pleasure Motorboats.

Myncke, H.
LAWAAIBESTRIJDING IN DE INDUSTRIE PROBLEEMSTELLING EN MEETMETODEN
(NOISE ABATEMENT IN INDUSTRY STATEMENT OF THE PROBLEM AND METHODS OF MEASUREMENT)
Ingenieursblad, v 42 n 9, May 1, 1973, p 235-241

After a classification of noise problems and the various noise types, the following topics are successively dealt with: the purpose of noise measurement, physical noise measurement, estimation of possible effects of noise on human organism, measuring equipment, and noise intensity measurement. 11 refs. In Dutch.

Peart, J. R.; Huber, T.V.
VEHICLE SOUND PACKAGE - ART OR SCIENCE?
SAE Pap 720508 for Meet, May 22-26, 1972

The quiet car concept succeeds in organizing and ranking noise inputs in an objective way and as such is a valuable tool in the hands of the noise control engineer. If lab test procedures can be developed to a trustworthy level, considerable time can be saved in evaluating and developing materials for future applications.

Modeling -

Reduction of Atmospheric Data -

Joglekar, P. J.
REVISION OF ATMOSPHERIC NOISE DATA
IEEE Trans Electromagn Compat, v EMC-14 n 2, May 1972, p 78-79

It is suggested that noise grade maps may be given to two frequencies rather than one to improve the accuracy of predictions. Further, predictions should be given for spot hours rather than on a time block basis as the time block concept has serious shortcomings.

Josephson, G. C.
ATMOSPHERIC NOISE STUDY PROGRAM
IEEE Trans Electromagn Compat, v EMC-15 n 2, May 1973, p 87

Replacement of noise grade maps by a computer program will give more accurate results than are now obtained. The means for accomplishing the change are discussed.

Reverberation Room Data Reduction -

Maling, G. C., Jr
COMPUTER STUDIES OF MODE-SPACING STATISTICS IN REVERBERATION ROOMS
J Sound Vibr, v 16 n 1, May 8, 1971, p 79-87

Normal mode-spacing statistics have been computed in third-octave bands for 200 cu m reverberation chambers having dimension ratios in ranges that have previously been found to be satisfactory. The results are compared with those obtained by L. W. Sepmeyer using a different normalization procedure, and contour plots are presented that can be used to identify rooms having optimum dimension ratios. 12 refs.

Maling, G. C., Jr
GUIDELINES FOR DETERMINATION OF THE AVERAGE SOUND POWER RADIATED BY DISCRETE-FREQUENCY SOURCES IN A REVERBERATION ROOM
J Acoust Soc Amer, v 53 n 4, Apr 1973, p 1064-1069

Experimental results are reported on the determination of the sound power produced by a single discrete-frequency tone in a reverberant environment, contrary to the general recommendations in ANS standard SL. 2-1962. It is shown that such measurements can be made if the effect of the reverberant room on the measurements and on the source are understood and accounted for. Data are given relevant to both the microphone path length required for determining the average pressure in the room and the variations of sound-power output with source position in the room. 23 refs.

Spindel, R. C.; McElroy, P. T.
LEVEL AND ZERO CROSSINGS IN VOLUME REVERBERATION SIGNALS
J Acoust Soc Amer, v 53 n 5, May 1973, p 1417-1426

A point scatterer model is used to derive expressions for the expected number of level crossings of backscattered volume reverberation signals. Results are obtained for both narrow-band and wide-band insonification of regions of high and moderate scatterer density. A narrow-band experiment in the ocean east of Bermuda gives the scatterer density as a function of depth through a scattering layer.

Miscellaneous Studies -

Cook, B. D.
ACOUSTICAL MODELING OF NOISE SOURCES UTILIZING CORRELATION TECHNIQUES
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Acoustical modeling of noise sources is usually performed in the frequency domain. However, there may be advantages in modeling in the time domain using correlation techniques. Examples of the mathematical procedures involved are illustrated by simple configuration.

Haag, F. G.
USING COMPUTER PROGRAMS AS NOISE CONTROL TOOLS
Sound and Vibr, v 5 n 9, Sept 1971, p 22-24

Prepackaged digital computer programs can be a major asset to the noise control engineer. Three computer programs that are used in the Union College Noise Control Institute are described. The first, called DBADD, facilitates the addition and subtraction of decibels and octave band combination. The second, CALCW, allows sound power level to be calculated from sound pressure level measurements. Finally the sound pressure level in a room which is caused by sound sources located in an adjacent room can be determined by the noise program.

Hawkins, W. M.
DYNAMIC ANALYSIS - A POWERFUL TECHNIQUE TO CONTROL NOISE AND VIBRATION
Noise Control Vibr Reduct, v 4 n 6, Nov-Dec 1973, p 237-243

The three closely related steps involved in performing dynamic analysis on any piece of complex machinery are outlined as follows: Step 1. Narrowband spectrum analysis while the machine is operating under normal conditions. This is to identify the frequencies and magnitudes of every important component of the machine's self-generated vibration; Step 2. Transfer function analysis while the machine is not operating. This is to identify the specific frequencies at which the machine is especially weak (resonances) and to determine how much the self-generated vibration is amplified or attenuated by the structure as it is transmitted through it; Step 3. Modal analysis while the machine is excited at each resonance.

This is to identify the form and severity of the vibration that occurs at each resonance. This "1-2-3" technique is developed in detail, and the application of several pieces of electronic equipment used to implement it is explained. Typical design analysis and test programs in the following areas are mentioned: automotive transmission; machine tools; truck chassis, mounts and cab; petroleum refining; automotive mufflers; earth-moving equipment. 12 refs.

Jackson, G. M.; Parkes, G.; Leventhall, H. G.
A COMPUTER STUDY OF THE RELATIONSHIP BETWEEN NOISE RATING ASSESSMENT AND DB(A) LEVELS
Appl Acoust, v 5 n 3, July 1972, p 191-204

The paper discusses the merits of using a single dBA reading in preference to the more complicated and time-consuming process of deriving an NR number. It is shown that, for commonly-encountered spectra, there is a small numerical difference between the dBA and NR values. This difference depends upon spectral shape and the overall level of the noise. 9 refs.

Konigova, M.
MATHEMATICAL AND STATISTICAL METHODS OF NOISE EVALUATION IN A RETRIEVAL SYSTEM
Inform Stor Retrieval, v 6 n 6, May 1971, p 437-444

A definition of noise, reasons for noise and methods of prevention are discussed; noise evaluation by using a contingency table and classification of content relevance are described; the method and effectiveness of the system as well as applications are considered. 14 refs.

Loucks, D. P.; Bower, B. T.; Spofford, W. O., Jr
ENVIRONMENTAL NOISE MANAGEMENT
ASCE J Environ Engr Div, v 99 n EE6, Dec 1973, p 813-829

The paper considers a quantitative modeling approach for the management of noise emanating from sources that cannot be controlled by those who hear them. Examined are two simplified separable programming (optimization) models that can be used as aids in the preliminary analysis of alternative noise management strategies.

Migneron, J. G.
L'ANALYSE DU BRUIT EN MILIEUX URBAINS (ANALYSIS OF NOISE IN URBAN ENVIRONMENT)
Ingenieur, v 58 n 274, Jan 1972, p 11-19

Three principal methods of noise analysis are discussed, normally spectral analysis, statistical analysis of intensity variation in time, and analysis of noise distribution in space. Methods and units used or the evaluation of auditive or physiological effects of noise, and suggested noise levels for different kinds of rooms, halls and workshops are listed in tables. 9 refs. In French.

Paulus, E.; Zwicker, E.
PROGRAMME ZUR AUTOMATISCHEN BESTIMMUNG DER LAUTHEIT AUS TERZPEGELN ODER FREQUENZGRUPPENPEGELN (COMPUTER PROGRAMS FOR CALCULATING LOUDNESS FROM THIRD-OCTAVE BAND LEVELS OR FROM CRITICAL BAND LEVELS)
Acustica, v 27 n 5, Nov 1972, p 253-266

The preparation of computer programs for calculating loudness is described according to Zwicker's graphical procedure. An attempt is made to base the programs on the psychoacoustic foundations of the procedure rather than on the recommended graphs alone. The necessary data and conclusions for this objective are specified and are shown to facilitate programming and to improve the precision of loudness calculations. In comparison with third-octave band levels, critical band levels will lead to more accurate results, and so also, a program to process the latter has been prepared. The basic data and relations are specified so as to support programming in both cases in any convenient programming language. Programs that are ready for use have been written in FORTRAN IV and are introduced together with instructions for the user. Moreover, correct application is also demonstrated by an example. Execution of the programs does not result in total loudness alone. Additionally, detailed information about the contribution of each third-octave band or each critical band is made available. 2 refs. In German with English abstr.

Sisson, W.
COMBINING SOUND LEVELS AND CORRECTING FOR BACKGROUND NOISE
Pollut Engr, v 4 n 2, Mar-Apr 1973, p 43

Frequently, sound levels must be combined. It is often necessary to add the effect of one sound to another, or to subtract the effect of one sound from a combination of sounds. The effects of both sound power and sound pressure are important. Since decibels are logarithms, they must be converted to relative powers, combined, and then converted back to decibels. A nomograph is constructed for rapid calculation of values.

Walker, R.: Alford, C.
COPING WITH NOISE IN ECL
Electron Prod, v 16 n 5, Oct 15, 1971, p 159,161-162

Noise margins are a measure of a system's susceptability to noise. This includes the effects of reflections, ringing and crosstalk. Test conditions and limits specified on emitter-coupled logic (ECL) data sheets provide a starting point for determining noise margins. To apply ECL, the engineer must be aware of this logic family's operating conditions -

supply voltage gradients, temperature gradients and signal line terminations are more critical than for transistor-transistor logic. If these parameters are not controlled, reduced noise margins will result.

Planning -

Control -

Nagel, R. G.
GUIDELINES FOR ACHIEVING A QUIETER CITY
Inst Environ Sci, Proc, 17th Annu Tech Meet, (Los Angeles, Calif, Apr 26-30) p 398-403

Description of measures taken by the city of El Segundo, California to reduce the general noise level at its airports, on its streets and in residential areas through the application of a noise ordinance. A recommended noise ordinance from the League of California Cities Quiet City Committee is presented.

Ollerhead, J. B.
NOISE: HOW CAN THE NUISANCE BE CONTROLLED?
Appl Ergonomics, v 4 n 3, Sept 1973, p 130-138

The various costs of aircraft noise, both monetary and social, are discussed in relation to its effects upon people. Although an economic analysis of the problem is feasible, it is doubtful whether understanding of the relationships between physical noise levels and human reaction is yet adequate for such purposes. Planning methods for estimating the extent of community noise nuisance are presented, and it is shown that consideration should be given to outlying regions exposed to relatively little aircraft noise. 9 refs.

Nowikas, W. M.
MANAGEMENT OF A NOISE CONTROL ENGINEERING PROGRAM
SV, Sound Vibr, v 6 n 3, Mar 1972, p 28-29

The effective management of a noise control engineering program requires: (1) that noise control programs be defined with care; (2) that specific technical competence be available to develop alternative solutions to noise control problems; and (3) that the selected solutions to the histories, related management-level decisions, and the results of these decisions are reviewed.

Bibliography -

Fowler, J. M.; Mervine, K. E.
NOISE POLLUTION
Univ of Md, Dept of Physics and Astronomy, Environ Resource Packet Project, 1974

An annotated bibliography on noise pollution is provided, along with a paper on noise in modern society and an outline for future legal research. Specific topics include community noise, noise measurement and control, effects of noise on man, and suggestions for student reading. Sources of noise pollution are discussed, including ground transportation, aircraft, construction, industry, and home appliances. Information is also provided on legislation, policies, and economics. A survey of basic general references is given.

Loudness Rating -

Garrelick, J. M.
REVIEW OF NOISE IMPACT ASPECTS OF ENVIRONMENTAL IMPACT STATEMENTS
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 291-392

The noise impact aspect of a number of environmental impact statements has been review for projects within the New England region. The projects include transportation facilities, e.g., highway and airport construction, as well as standard building construction. Different levels of effort were apparent. These ranged from complete surveys of ambient levels plus detailed predictive schemes to a few cursory remarks. Various acceptability criteria and analyses were employed. However, a number of generalizations can be made. Means for improving efficiency of preparation and presentation of these statements are suggested.

Richards, D. L.
NEW DEFINITIONS FOR LOUDNESS RATINGS
Electron Lett, v 9 n 19, Sept 20, 1973, p 448-450

The results, now available, of new tests by the CCITT Laboratory are used to examine some of the consequences of adopting proposals for new definitions for loudness ratings.

Robinson, D. W.
TOWARDS A UNIFIED SYSTEM OF NOISE ASSESSMENT
J Sound Vibr, v 14 n 3, Feb 8, 1971, p 279-298

Different indices are in current use for expressing the nuisance value of successions of noises, according to the type of noise. It is shown that a single index, termed noise pollution level, accommodates the experimental results of surveys of aircraft and motor vehicle noise. The index is based on two terms, one representing the equivalent continuous noise level on the energy basis, and the other representing the augmentation of annoyance when fluctuations of noise level occur. Practical and theoretical implications of the index are discussed. 15 refs.

Schneider, A. J.
ENVIRONMEN[illegible] NOISE CLASSIFICATION
IEEE Inter[illegible] Tech Pap for Meet, (New York, N. Y., Mar 26-30, 1973)
v 7 Pap 3[illegible]4

In the fields of noise abatement and municipal planning, there are new requirements for measurement of the statistical distribution of noise levels in the environment, or they may require determination of the noise level exceeded 10, 50 or 90 percent of the time. An instrument developed for these requirements is described. The environmental noise classifier measures the time spent in a series of amplitude bands. Following OSHA (Occupational Safety and Health Act) requirements, the bands are alternately two and three dB wide. The base line is adjustable from 60 dBA (45 dBA on special order) to 100 dBA. There are 12 bands, the top band having no upper limit. If the level goes below the base line, its time will be represented by the difference between the total time meter and the sum of the 12 individual band windows.

General Discussion -

Bragdon, C. R.
NOISE POLLUTION: THE UNQUIET CRISIS
Noise Pollution: The Unquiet Crisis, Univ of Penn Press, Pa, 1971

Three interrelated objectives are focused upon: to evaluate the social basis for the existence of noise pollution; to investigate methods of abating noise and the status of the noise abatement programs; and to assess the subject of noise as an urban environmental health problem, noting consciously perceived as well as insidious effects. A model is described presenting the three approaches from which noise can be managed -- the source, the path, and the receiver. Specific suggestions for controlling aircraft noise are offered, based on this model.

Carlestam, G.
NOISE--THE SCOURGE OF MODERN SOCIETY
Ambio: J Human Environ, Res and Mgt, v 1 n 3, June 1972, p 102-109

Unwanted sound is one of the most prevalent waste products of the present age and is a major stress factor in the modern, industrialized society. Some psychological and physical aspects of the noise problem are examined. Topics include annoyance reactions to noise, the interpretation of sounds, noise-reduction measures, aircraft noise in an urban region, and methods for determining buffer zones. It is shown how urban and regional physical planning can eliminate the negative effects of aircraft noise for the 115,000 residents around Arlanda airport in the greater Stockholm area.

Planning -

Bragdon, C. R.
COMMUNITY NOISE
Acoust Soc of Amer, J, v 5 n 1, Jan 1973, p 291-392

The magnitude of the existing urban noise problem is presented in terms of its acoustical characteristics and environmental impact. The current status of community noise research, including acoustical as well as social analysis, is summarized. Implicated environmental health effects involving potential hazardous and nuisance responses to community noise are identified. Public as well as political recognition of community noise is compared to other environmental problems. Existing and proposed noise management programs at all governmental levels are assessed in terms of their relative effectiveness, including protecting the public's interest. A few existing programs that sufficiently address the problem are given. The current inadequacies and requirements for more active and comprehensive noise management programs are apparent. Effective coordination of environmental programs at all governmental levels is also needed. Present governmental policies and their ability to control community noise successfully are discussed, including considerations in establishing standards.

Bragdon, C. R.
NOISE CONTROL IN URBAN PLANNING
ASCE J Urban Plann Dev Div, v 99 n UP1, Mar 1973, p 15-23

The impact of noise on the health and well-being of the population is described. A method for appraising the implicated health effects of noise is discussed and noise problems associated with both ground and air transportation systems are presented. The role of urban planning in mitigating noise impact is assessed, and examples are presented. 28 refs.

Bragdon, C. R.
URBAN PLANNING AND NOISE CONTROL
Sound and Vibr, v 7 n 5, May 1973, p 26-32

Noise represents a major environmental problem capable of being a nuisance or a hazard to the population. The four stages of implicated health effects of noise are illustrated and two nuisances of stage four are discussed: Damage to physical objects and invasion of privacy. Several land use management techniques for noise abatement are discussed, including site design analysis, environmental zoning, building codes, noise ordinances, and Federal Environmental Legislation. The future noise status of urban areas is dependent upon controls either initiated by or implemented by the urban planning profession.

Thring, M. W.
CHEMICAL POLLUTION OF AIR, LAND AND WATER
Soc of Environ Engrs, Environ Engr Aspects Pollut Control, Symp, (London, Eng, June 22-23, 1971)

The question of what steps can be taken to save the environment are examined from the viewpoints of chemical pollution, noise, exhaustion of mineral resources and reducing the number and types of accidents.

Buckley, N. A.
POLLUTION OF THE ENVIRONMENT
J Inst Munic Engr, v 99 n 3, Mar 1972, p 92-97

General discussion of the problems of pollution of the sea, pollution of rivers, atmospheric pollution, noise, pesticides and artificial fertilizers, and solid wastes. 8 refs.

Caccavari, C.; Adams, J. V.; Hurlburt, R. L.; Bragdon, C. R.
SV STATUS REPORT: THREE COMMUNITY NOISE PROGRAMS
Sound and Vibr, v 7 n 5, May 1973, p 42-44

A series of 14 questions was presented to the administrators of the noise programs in Boulder, Colorado; Chicago, Illinois; and Inglewood, California. The administrators' replies to these questions are presented. The questions were concerned with operating costs; organizational and administrative aspects; acoustical instrumentation; cooperation with other public agencies; public and private awareness; and accomplishments, needed improvements, and future plans for noise control.

Goodfriend, L. S.; Kessler, F. M.
INDUSTRIAL NOISE-IMPACT ON THE COMMUNITY
J Environ Sci, v 15 n 5, Sept-Oct 1972, p 18-22

The subject of the article is the impact of industrial noise pollution. Attention is given to noise at the workplace. The description of community noise is proposed and it is shown that industrial noise in the community which is above the ambient may be accepted or allowed by the community so long as it meets certain limitations.

Guernsey, R. M.
COMPUTER ANALYSIS OF CITY NOISE--A PRELIMINARY ALGORITHM
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

A preliminary computer algorithm was developed to analyze city noise. The algorithm is eventually to be included in an overall cost effectiveness program for city noise control. The basic problems, some unsolved in the present state-of-the-art, which were encountered during the development of this algorithm are discussed. The basic structure of the algorithm is described. It is believed that this algorithm can be readily expanded and improved as the state-of-the-art improves.

Harland, D. G.
ANALYSIS OF COMMUNITY NOISE LEVEL DATA
J Sound and Vibr, v 30 n 2, Sept 22, 1973, p 253-254

A discussion of a comprehensive paper on the statistics of community noise level is presented. There is some difference between the analytical technique employed in this paper and the technique commonly used in England, which would involve determination of the cumulative distribution of sound levels. The effects of class intervals and boundaries are discussed.

Higham, J. D.; Dewar, I. S.
PLANNING AND NOISE
Gt Brit Dept of Environ, Library Circular 10/73, Jan 1973

Principles and specific criteria are presented, with particular reference to noise from roads, aircraft, and industry, by which the secretaries of states will be guided in making planning decisions and on which they will urge local planning authorities to base their own policies. Specifically, the siting of new development expected to give rise to noise and the siting of houses, schools, etc. which may suffer from noise are discussed. These guidelines are directed primarily at the control of development.

Kshirsagar, S. R.
NOISE AS AN OCCUPATIONAL HAZARD AND PUBLIC NUISANCE
J Inst Engr (India), Pub Health Engr Div, v 53 pt 2, Feb 1973, p 60-63

The paper presents a survey of the major sources of noise, especially the industrial establishments, their effect, the noise levels in different kinds of indoor spaces and urban localities and the methods of controlling and abatement of the noise in the urban atmosphere.

Leach, J. S.
NOISE IN TOWNS
Noise Control Vibr Reduct, v 5 n 1, Jan 1974, p 9-15

Achievements and potential benefits of research conducted by the building research establishment (BRE) in the London area into the main aspects of urban environmental noise are reviewed. Except near airports, road traffic is the most important noise source, especially at night. Data are shown for daytime and nighttime noise-level ranges at seven classes of location where traffic noise predominates. In terms of "noise climate" (dBA range recorded for 80 percent of the time). A reference called the "18 hr L//1//0" index has been adopted in road planning for noise abatement. This index refers to the average noise level exceeded for 10 percent of the time during the 18 hours from 0600 to 2400 hours. An absolute value for L//1//0 at which noise abatement procedures should be undertaken has not been established, but is expected to be in the region of 70 dBA. One noise abatement procedure being investigated along limited-access highways has been the erection of "traffic noise barriers" paralleling the highway where residences border it. When barriers are impractical, and for aircraft noise, installation of double windows plus provision of mechanical ventilation with sound-attenuating air inlet has been tried; noise levels may thus be reduced 35 dB below outdoors.

Lewis, Ron
NOISE POLLUTION
Collection Environ Conserv Studies, Dept City Plann, Adv Plann Div, Los Angeles, Calif, Aug 1970

Urban noise and its general impact on the environment are discussed. Methods by which noise levels can be measured or calculated are presented, and the physiological and psychological effects of urban noise on man are considered. Major local sources of noise, including air and surface transportation systems, residential sources (apartments, playgrounds, and neighborhood pets), and commercial and manufacturing sites are discussed. Policy recommendations for the reduction of urban noise levels given include: adopt a quantitative noise standard for operations at Los Angeles International Airport, limiting noise levels to 90 PNdB (perceived noise level) or lower at the airport boundary; modify the westerly take-off pattern at the airport to effect its extension to the west; apply an 85 PNdB standard to all commercial helicopter operations; propose the passage of stricter quantitative noise standard and enforce current noise regulations governing motor vehicle operations; requiring the use of acoustical insulation in all new residential buildings; and adopt quantitative noise standards governing all construction equipment operating in the city.

Nambi, K.; Agarwal, A. L.; Ramanathan, N. L.
NOISE POLLUTION IN AHMEDABAD
Environ Pollut and Its Control (Baroda, India, Apr 15-17, 1972), p 24

Results of a survey of the noise environment in the city of Ahmedabad, India, indicate that traffic noise is the major noise source. Several measures are recommended to alleviate the problem and a "noise map" of the city is included.

Richards, E. J.
THE NOISE ENVIRONMENT IN THE UNITED KINGDOM
Soc of Environ Engrs, J, v 12-1 n 56, Mar 1973, p 2-10

Efforts to minimize the noise environment are complicated by two facts: reducing the noise energy emanating from an industrial device generally requires radical redesign, and reduction of noise levels must be great before a change in apparent loudness can be noticed. Studies substantiate a serious noise problem in the United Kingdom. A survey of the situation for the next 10 years is made for noise from traffic, aircraft, factories, and the community. Recommendations are made for town planning, establishing standards, machine design, and other areas of possible abatement methods.

Safeer, H. B.
COMMUNITY NOISE LEVELS--A STATISTICAL PHENOMENON
J Sound and Vibr, v 26 n 4, Feb 22, 1973, p 489-502

The increasing interest in community noise levels generated numerous community noise measurement programs. The statistical variability in community noise levels and the potential errors associated with the data collection and analysis procedures are considered. The need for proper study design is emphasized and order of magnitude estimates of the degree of error which can be introduced by improper design are developed.

Schmitz, C. J.
WIEWEIT IST LAERMSCHUTZ MOEGLICH? (HOW FAR IS NOISE CONTROL POSSIBLE?)
Ind-Anz, v 94 n 28, Apr 4, 1972, p 590-594

Problems of noise control are discussed based on examples derived from four principal groups of application. These include: (1) sound-absorbing walls against traffic noise, (2) sound-absorbing walls and structures against airport noise, (3) control of industrial noise, noise generated by diverse equipment and appliances, and (4) noise molestation at the work place. In German.

Ward, E. W.
AIR POLLUTION AND TOWN PLANNING
Soc Environ Engr, Environ Engr Aspects Pollut Control, Symp (London, Eng, June 22-23, 1971) Sect G

It is shown that government and municipal authorities could better improve the protection of the environment from pollution by insisting upon a multi-disciplinary approach to all city planning problems. Such factors as monitoring air pollution, noise pollution, aircraft and motor vehicle noise and smoke and fumes from vehicles and aircraft are discussed.

Winnicki, R.
DEVELOPMENT CONTROL AND PLANNING
Noise in the Environment: Causes, Effects, Controls, Conf, Pap (Toronto, Ont, Canada, Apr 28-29, 1971)

Stopgap measures taken by the Canadian government to reduce and control noise are reviewed, with emphasis on legislation enacted by Ontario. Municipal development plans, zoning and land use policies, and building codes are considered. Federal and provincial standards that apply across municipalities are needed, especially for industrial, aircraft, and truck noise.

Conferences, Seminars -

Henderson, V. L.
NOISE: ITS SOURCES, MEASUREMENT AND CHARACTERISTICS
Noise in the Environment: Causes, Effects, Controls, Conf, Pap,
(Toronto Ontario, Canada, Apr 28-29, 1971)

Physical and psychological aspects of noise measurement are discussed, and ways of predicting how people will emotionally react to certain sounds are considered. The use of judgment and adequate communication is the best way to control noise, since what is thought of as an annoying noise to one person may not be annoying to another. The rights of the complainant should be balanced against the rights of the noisemaker; and the amount of annoyance, inconvenience, interference, and gravity of harm to the complainant should be weighed against the utility of the conduct of the noisemaker.

Northwood, T. D.
INTRODUCTION TO NOISE
Ind Waste Mgt, Symp, Abstr, (Sheridan Park, Ontario, Canada, Nov 3-4, 1971)

The solution of noise problems has two aspects: description and quantification of the physical noise and assessment of subjective reactions to the sound. The establishment of physical criteria that will reliably predict subjective assessments of noise is the primary objective of current research and standardization in the field of noise. Major categories of noise from both aspects are surveyed. Some general remarks about current approaches to noise control are presented.

Thiessen, G. J.
NOISE IN THE 70'S
Noise in the Environment: Causes, Effects, Controls, Conf, Pap,
(Toronto, Ontario, Canada, Apr 28-29, 1971)

Rising community noise levels are discussed, and the ways in which the size of a city affects noise intrusion are considered. The effects of noise on hearing loss and sleep are examined, and annoyance caused by noise is analyzed. Studies on environmental variables that may affect a person's sensitivity to noise are cited.

Anon
CONFERENCE ON NOISE AND VIBRATION CONTROL
Cardiff: Univ of Wales, Inst of Science and Tech, 1973

Practical as well as theoretical aspects of noise and vibration control were considered during the conference. The specific topics covered include criteria and standards; reducing exposure of employed persons to noise; legal aspects of noise control; the control of neighborhood noise; traffic noise control; internal noise in buildings; and vibration and service noise in buildings.

Bruckmayer, F.
LAERMSCHUTZ IM STAEDTEBAU
Noise 2000, Assoc Intl Contre le Bruit, Intl Congresses, 5th, 6th, (London, Eng, May 1968 and Groningen, Neth, May 1970)

The protection of the population from noise in the context of town planning is discussed. Six categories of quiet protection zones were elaborated in research work, and this zoning is also substantiated by a draft drawn by the international standardization organization, which lays down standard planning values for immission. In contrast, noise emission sources of town planning are thoroughfares, town motorways, railway lines and stations, parking places, playgrounds and sport fields, markets, workshops, and manufacturing plants of varying sizes right up to the industrial area as a whole emitting surface. Between emission and immission, propagation of sound in relation to the type of area should be known, together with influence of the building site to the road, screening effect of courtyards in residential buildings, and protection by green belts. Results of measurements concerning the problem of noise protection in urban planning are also given.

Hartig, H.; Junghans, R.
ORGANISATION UND WIRKSAMKEIT DES LAERMSCHUTZE IN DER DDR
Noise 2000, Assoc Intl Contre le Bruit, Intl Congresses, 5th, 6th, (London, Eng, May 1968 and Groningen, Neth, May 1970)

The organization of essential elements of noise control in the German Democratic Republic is described, and it is shown in what way noise control will become effective. Some basic principles are stated; how they are realized and put into practice by efficacious incorporation into the managerial and leading activity in factories; complexes of factory plants, and industrial branches as well as by incorporation into the governmental and social supervision is explained.

Hub, D. R.
PRINCIPLES OF NOISE CONTROL
Noise and Vibr Control for Ind, Conf, Pap, (Bath, Eng, Apr 10-12, 1972)

Noise control is the technology of obtaining an acceptable noise environment at a receiver consistent with economic and operational considerations. The receiver may be, for example, a group of people, an entire community, or a piece of equipment. Various aspects of noise control are discussed: reasons for noise control; economic considerations; points of attack; statistical aspects; interaction between source, path and receiver; noise control at the source; control of the transmission path; noise control at the receiver; and systematic noise control.

Large, J. B.
NOISE CONTROL
Noise and Vibr Control for Ind, Conf, Pap, (Bath, Eng, Apr 10-12, 1972)

Measurement and assessment of the impact of noise are discussed. Noise affects society in two ways: it produces damage to the hearing mechanisms if intensity of the noise is too high or if the human is subjected to excessive periods of noise;and secondly, at lower intensities, it produces a state of mental disturbance. Problems and solutions for aircraft noise and sonic booms, traffic noise, and industrial and domestic noise are discussed.

Pretlove, A. J.
BASICS OF NOISE
Noise and Vibr Control for Ind, Conf, Pap, (Bath, Eng, Apr 10-21, 1972)

An introduction to acoustics as a form of wave motion is presented. Making physical measurements of sounds is covered together with the subjective side of acoustics. These subjects are related via the fundamental datum pressure of physical measurements. Definitions are given of the decibel (dB), and some of the simpler forms of loudness scale are described. Important physical characteristics of noise sources which are necessary to know about in order to control noises at their source are covered. Various facets of sound in rooms and buidings are examined.

Zonderland, P. (ed)
NOISE 2000
Noise 2000, Assoc Intl Contre le Bruit, Intl Congresses, 5th, 6th, (London, Eng, May 1968, Groningen, Neth, May 1970)

From the fields of science, economy, and administration, papers are presented on new-found knowledge in the branches of medicine, noise prevention techniques, and law. Topics cover progress in noise control in various countries, aircraft noise, effects of noise on people, industrial noise, methods of noise assessment, traffic noise, and noise in construction and in buildings. Resolutions of the participants in the Sixth International Congress for Prevention of Noise regarding promotion of noise reduction are also itemized.

Zonderland, P.
THE COMBATING OF NOISE IN THE ENTIRE WORLD AND IN HOLLAND
Noise 2000, Assoc Intl Contre le Bruit, Intl Congresses, 5th, 6th, (London, Eng, May 1968, Groningen, Neth, May 1970)

Development of noise control in the Netherlands is outlined. International noise legislation, and the way in which the standards are internationally matched and their degree of applicability, are important for noise control. Introduction of special divisions for prevention of noise within police forces, introduction of an international certificate to be awarded to those manufacturers for products whose production does not exceed an acceptable sound level, evaluation of present national anti-noise magazines, and prohibition of supersonic civil air traffic are recommended for international support. In Holland, a more adequate use of the knowledge at the disposal of TNO (Toegepost Natuurwetenschappelijk Onderzoek), and coordination of all groups concerned with partial or regional aspects of noise are needed.

Pearce, D.
THE ECONOMIC EVALUATION OF NOISE-GENERATING AND NOISE ABATEMENT PROJECTS
Problems of Environmental Economics, Seminar, Pap, (Paris, France, June-Aug 1971)

Problems of economically evaluating noise nuisance and noise abatement are discussed. Projects affecting the noise environment may be either abatement projects or projects in which noise is a joint product; both are susceptible to a benefit-cost evaluation. Although increased noise levels may be associated with slower rates of appreciation in property prices, the extent to which price differentials reflect disamenity costs is difficult to assess. The Roskill research team used a property-price model to value the noise disamenity arising from London's planned third airport. A modified property-price model is proposed to eliminate some of the theoretical deficiencies of the Roskill and other models. Limitations of the proposed model include the effects of new technology when abatement measures are introduced and the health effects of noise.

Bose, B., Bhattacharyya, A. K.
NOISE AND COMMUNITY
Environ Pollut and Its Control, Seminar, Abstr, (Baroda, India, Apr 15-17, 1972)

The environmental noise problem is examined by discussing procedures for assessing noise annoyance, control methods, and other aspects of noise pollution.

Anon
A IV-A CONFERINTA NATIONALA DE ACUSTICA
Proc: Academy of the Socialist Republic of Romania

Papers on acoustics and noise control are presented. Noise and vibration reduction, room and architectural acoustics, ultrasonics, and the physiological, psychological, and biological aspects of acoustics are examined. Specific topics included the problems of modern acoustics, the response of building structures under seismic actions, apparatus for vibrations and noise measurement, acoustic analytical techniques, gear noise, locomotive noise, noise in coal mines, aircraft noise, medicosocial problems, hearing thresholds, and noise effects in various industries.

Anon
ENVIRONMENTAL EXHIBITION PRO AQUA-PRO VITA (UMWELTSMESSE PRO AQUA-PRO VITA)
Kunstst-Plast, v 18 n 6, 1971, p 231

This is a brief report on the International Fair for Environmental Protection held in Basel, Switzerland. International conference included three papers devoted to pollution of water and air as well as to noise control. In German. 44361

Anon
BIBLIOGRAPHY ON NOISE CONTROL
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

A bibliography was compiled from the references given in the papers presented at the 1972 International Conference on Noise Control Engineering. The references are mainly on acoustics and noise controls and were arranged under the following headings: general; surface transportation noise; legislation and city planning; aircraft noise and vibration control, including general topics, compressor fan and propeller noise, jet noise, and turbulence noise; noise in buildings; noise instrumentation and measurement; and materials for noise control.

Anon
EIGHTY-THIRD MEETING OF THE ACOUSTICAL SOCIETY OF AMERICA
Acoust Soc of Amer, 83rd Meet, Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Problems related to noise pollution were discussed in sessions on architectural acoustics; psychological and physiological acoustics, temporary and permanent threshold shift; noise control for vehicles and stationary noise sources; jet and propeller noise; community noise; machine noise; and noise measurement and the effects of noise on man.

Anon
ENVIRONMENTAL POLLUTION SYMPOSIUM: NOISE
In Water, Air, and Soil Pollution, v 2 n 3, Sept 1973, p 253-402

Papers are presented on the nature of noise, the effects of noise on society, specific noise problem areas, and potential actions to curb noise. Workshop discussions on industrial noise, aviation noises, noise of homes, vehicular noise, and highway noise are included.

Anon
NOISE POLLUTION RESOURCES COMPENDIUM
New Mexico Univ, Inst for Social Res and Dev, TAC Bibliog Series 2,
Mar 31, 1973

Complete abstracts of current material on various aspects of noise pollution are presented. The contents are arranged under subjects headings which are judged major areas of noise pollution activity. These include sources of noise, noise detection and measurement, noise abatement and control, physical effects of noise, and social effects of noise. An index at the end of such subject group simplifies cross reference of interrelated articles.

Anon
NOISE POLLUTION RESEARCES COMPENDIUM
New Mexico Univ, Inst for Social Res and Dev, TAC Bibliog Series 2,
Dec 31, 1972

References with which to better understand noise in terms of its physical properties, which may be measured, and its nonphysical effects on human populations are provided. The articles and books which were located are indexed by keywords. To further improve the usability of the compendium the citations are categorized into eight major sections with each of these subclassified into a number of subsections. The sections include noise sources, noise detection and measurement, noise abatement and control, the physical effects of noise, noise regulations and standards, patents and contracts, and noise research.

Anon
SYMPOSIUM ON ATMOSPHERIC ACOUSTICS AND NOISE PROPAGATION
Atmospheric Acoustics and Noise Propagation, Intl Union of Pure and
Appl Physics, General Assembly, (Gaithersburg, Md, Sept 27-29, 1972)

Abstracts are given for papers on the following aspects of atmospheric acoustics and noise propagation: remote sensing, absorption, scattering reflection, infrasound, acoustic-gravity waves, nonlinear acoustics, sonic boom, and other aircraft noise. Urban traffic noise and noise standards are also discussed.

Cavanaugh, W. J.
COMPOSITE MATERIALS FOR NOISE REDUCTION
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap (Wash,
D. C., Oct 4-6, 1972)

The ability of certain materials to absorb, isolate, or damp sounds is discussed. Composite materials are those which provide sound absorption coefficients greater than 50 percent and sound transmission or insertion losses greater than 10 dB over a desired frequency wave. Composite materials may also provide effective structural damping of vibrating surfaces as well as sound absorption and barrier effects. Composite materials used in building components, suspended ceiling systems, layered glass, wrappings, and enclosures are described.

Crocker, M. J. (ed)
INTER-NOISE 72
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap, (Wash, D. C., Oct 4-6, 1972)

A set of tutorial lectures was arranged to cover the basics of noise and vibration control engineering. Discussions are included on the following topics: sound propagation; the effects of noise on man; noise legislation; noise reduction accomplished by enclosure, absorption; industrial noise and noise in buildings; instrumentation and identification of noise and measurement of noise from machines. Appendices on the use of anechoic and reverberant rooms, and the ear and loudness are included along with a selected bibliography on noise control.

Crocker, M. J. (ed)
NOISE AND VIBRATION CONTROL ENGINEERING
Noise and Vibr Control Engr, Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

The state-of-the-art and recent developments in noise control technology are covered in papers presented at the nine sessions of a noise control conference held at Purdue University, July 14-16, 1971. The first session was concerned with many aspects of surface transportation noise. Other sessions dealt with: machinery noise; industrial noise; vibration control; legislation and city planning; noise and vibration control; noise in buildings; and two sessions devoted to aircraft noise; sources of noise in aircraft; and jet noise and sonic booms. A complete bibliography of all references given in the papers is included.

Crocker, M. J.
NOISE CONTROL APPROACHES
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap, (Wash, D. C., Oct 4-6, 1972)

All noise control problems can be reduced to a determination of the dominant noise source-path-receiver system. Noise reduction procedures should be chosen on the basis of cost, effectiveness, and convenience. The simultaneous use of more than one approach (e.g., vibration isolation, enclosure, and absorption) is often the most effective and economic solution to a noise problem. Noise reduction techniques applied to the source, path, and receiver are outlined, and the amount of noise reduction required is discussed.

Crocker, M. J.
NOISE CONTROL IN THE USA--THE PRESENT STATE OF AFFAIRS
Noise and Vibr Control Engr Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

The present state of affairs in noise control in the USA is described. Noise sources, criteria, legislation, and control approaches are discussed.

Filippov, V.; Llyashuk, Y.
APPROACH TO THE PROBLEM OF NOISE CONTROL IN THE SOVIET UNION
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 14-16, 1972)

Noise abatement in the USSR was initiated by the Leningrad Labor Protection Institute. The hearing of workers was correlated with their length of service and the physical characteristics of noise, and norms and regulations for noise reduction in industry were established. Regulations requiring manufacturing plants to determine the sound power frequency spectra of machine-produced noise were also passed. Current emphasis is on accomplishing noise reduction in production areas by construction and acoustic procedures; developing methods for establishing technical norms for machine-generated noise; and eliminating noise at its source.

Ingard, U.
PRINCIPLES OF NOISE CONTROL
SAE, Intersociety Energy Conversion Eng Conf, Pap 719137, (Boston, Mass, Aug 3-5, 1971)

Johnson, J. C.; Stuart, A. D.
SUMMARY REPORT FOR THE CONFERENCE ON ACOUSTICS AND SOCIETAL PROBLEMS
Acoust Soc of Amer, J, v 54 n 1, July 1973, p 1-10

All organizations perform evaluations of their own purposes and effectiveness. The efforts of the Acoustical Society of America to this end during the past three years have included special studies of the ad hoc committee on the effectiveness of the society. Recommendations of this committee have resulted in a revitalization of activities in standards, formulization of a committee and programs in environmental acoustics, and the organization of a conference on acoustics and societal problems. The conference addressed the definition of problems of society at large which are of particular conern to the society as a corporate body, and to its members. The conference established several vital elements--ranging from improved communications, through delineation of unsolved basic and applied research problems, to needs for strong leadership by the Acoustical Society of America--if an increased rate of progress is to be achieved during the next decade in areas dependent upon acoustics.

Jones, H. H.
EFFECTS OF VARYING LEVELS OF INTERRUPTION ON TEMPORARY THRESHOLD SHIFT
Amer Ind Hygiene Conf, (San Francisco, Calif, May 14-19, 1972)

Intermittency is a noise exposure variable which must be considered in proposing standard limits. A noise interruption is a period in the noise exposure when the level falls below 80 dBA for more than five minutes or for 20 percent of the duration of the preceding noise burst. Interruption levels below 80 dBA may have variable effects on resultant temporary threshold shifts. Thirty subjects were exposed to noise bursts wherein the only variable was the level of noise during interruption. The resultant temporary threshold shifts from these exposures are discussed.

Lindsay, R. B. (ed)
THE EIGHTY-SECOND MEETING OF THE ACOUSTICAL SOCIETY OF AMERICA
Acoust Soc of Amer, Meet, 82nd, Abstr, (Denver, Colorado, Oct 19-22, 1971)

The abstracts of proceedings of the October 1971 meeting of the Acoustical Society of America are presented. Sessions focused on noise standards, progress in noise control, aircraft, airport, and community noise, and vehicle noise. Paper topics included: vibration control and biodynamics; power plant noise; air-to-ground sound propagation; airport noise monitoring; laboratory simulation of sonic boom and its effects on sleep and human performance; operational noise levels of motor vehicles; spectral and directional characteristics of truck tire noise; tentative damage risk criteria for noise of inflatable restraint systems; and others.

Poertner, H. G.
REQUIREMENTS FOR COMMUNITY NOISE CONTROL PROGRAMS
Noise and Vibr Control Engr, Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

Ways are suggested in which community noise control efforts can be developed into effective area-wide programs. The need for identifying and establishing "incentives-to-quiet" is analyzed and the need for various groups of individuals and organizations to unite and motivate others to make-a-quieter-city is explained. An overview is given of attitudes, problems and difficulties in developing coordinated action programs. Some general estimates of the dimensions of community noise problems and the costs of remedies are discussed. Typical technological problems involved in silencing noise produced in construction operations are mentioned to illustrate the problems encountered and the general dichotomy of motivations and objectives of people. Some of the questions that should be considered by municipal governments prior to embarking upon a noise control program are outlined.

Richard, E. J.
NOISE AND SOCIETY
Noise and Vibr Control Engr Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

A system of accountancy and control of noise in occupational deafness, traffic location, and airport design is discussed. The situation around airports in the United Kingdom and traffic in London are given as examples.

Ruzicka, J. E.
FUNDAMENTAL CONCEPTS OF VIBRATION CONTROL
Noise and Vibr Control Engr Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

Fundamental vibration control concepts for reducing undesirable mechanical vibration and acoustic noise effects are discussed. The general nature of vibration environments is reviewed, and methods for providing vibration control are categorized. Practical considerations involved in applying the various methods are discussed, and typical degrees of attenuation available from each method are indicated. Both passive and active control system mechanisms are considered, with discussions provided of the relative advantages and disadvantages of each. The availability of commercial products is indicated for each method of vibration control discussed.

Taylor, R.
ENGINEERING CONTROL--EUROPE
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

The shortcomings of the European noise control engineering approach are reviewed, and the tendency to apply traditional measures such as sound insulating/absorbent enclosures, screens, and room linings is discussed. Although these methods are often successful, the acoustical enclosure is often costly and should be used as a last resort. Reduction of noise at the source is suggested, and manufacturers of acoustical materials and devices should be required to provide noise control in their equipment. Noise control measures taken in a chocolate factory, a bottling plant, and a Sperry Rand plant are reported.

Franken, P. A.
PEOPLE AND NOISE CONTROL
Noise in the Environment: Causes, Effects, Controls, Conf, Pap, (Toronto, Ontario, Canada, Apr 28-29, 1971)

Noise control is discussed, including absorption and barrier construction. The use of trees and grasses as acoustical barriers is cited, and enclosures are considered for industrial situations. Automobile noise is also examined.

Sport Equipment -

Campbell, R. A.
SURVEY OF NOISE LEVELS ON BOARD PLEASURE BOATS
SV, Sound Vibr, v 6 n 2, Feb 1972, p 28-29

A survey of noise levels on-board pleasure boats was carried out. It was found that under normal operating conditions the noise levels in the majority of power boats at and above cruising speeds are comparable to those measured in jet airliner cockpits and are sufficient to render speech communication and radio monitoring virtually impossible and also to produce danger of hearing loss with prolonged daily exposure. 5 refs.

Chaney, R. B., Jr; McClain, S. C.; Harrison, R.
RELATION OF NOISE MEASUREMENTS TO TEMPORARY THRESHOLD SHIFT IN SNOWMOBILE USE
Acoust Soc of Amer, J, v 54 n 5, Nov 1973, p 1219-1223

To evaluate and quantify snowmobile noise measurements were made as follows: operator at-ear A-weighted sound levels and exposure patterns; A-weighted levels at 50 ft to develop a test procedure for law enforcement purposes; temporary threshold shift (TTS) in snowmobile users. Results indicate that TTS of varying degrees was observed in 87 percent of snowmobile operators tested after operations periods as short as one-half hour; for typical recreational riding, the Federal Occupational Safety and Health Act of 1970 noise limits are exceeded after approximately two and one-half hours of snowmobile operation; the 50 ft noise level measurement procedure to measure the amount of noise produced by a snowmobile for law enforcement purposes. More correlation of data would be desirable.

Curtis, J.; Sauer, R. C.
AN ANALYSIS OF RECREATIONAL SNOWMOBILE NOISE
Sound and Vibr, v 7 n 5, May 1973, p 49-50

The noise levels of 10 snowmobiles were measured under controlled conditions. The data showed that snowmobile noise is hazardous to the hearing of the operator and either restricted exposure times or the use of hearing protectors should be considered.

Nowak, K. F.
EXTERIOR SOUND LEVEL FOR SNOWMOBILES FROM SAE J192 to SAE J192A - BACKGROUND AND INSIGHT
SAE Prepr n 730773 for Meet, Sept 10-13, 1973

The environmental impact of snowmobile noise has received widespread publicity over the past few years. In order to define and solve any noise problem, a satisfactory and repeatable measurement practice must be evolved. In the case of SAE J192, the particular operating environment of snowmobiles proves a challenge to this task. Environmental conditions affect not only the propagation of sound at the test site, but also the performance of the vehicle itself. This results in a potential for significant variation in the sound pressure level of the sound source. Hence, the test procedure must be designed so as to minimize if not eliminate such sources of variations.

SIC 16 - Construction Equipment

Anon
QUIETER SHEET PILE DRIVING
World Constr, v 27 n 4, April 1974

A new sheet piling machine, the impulse driver, developed in Sweden is outlined. Outdoor noise readings taken 7 m from the piling machine average 86 dBA for the impulse driver compared to 96 dBA for a drop hammer.

Barber, A. D.
RECENT DEVELOPMENTS IN SILENCING PNEUMATIC MACHINERY
Noise 2000, Assoc Intl Contre le Bruit, Intl Congr, 5th & 6th, (London, May 1968 and Groningen, Netherlands 1970)

Noise in pneumatic tools comes from two main sources: discharge to the atmosphere of high pressure air through exhaust outlets, and vibration produced by metallic impact of tool components. Noise reduction in pneumatic road breakers can be accomplished by a hard durable plastic double-chamber silencer. Also available are two silenced portable compressors of a type normally used in developed areas and on construction sites to operate road breakers and other hand tools. Silencing is achieved by the following improvments: the glass fiber canopy is lined with absorbent plastic foam combined with antidrumming compound, the enclosure is improved by incorporation of trays under the compressor and a transparent gauge panel access door, engine exhaust noise is reduced by a pair of tandem exhaust silencers, a lined cooler duct directs cooling air downward, and the canopy is flexibly mounted.

Baron, R. A.
CONSTRUCTION NOISE, A CITIZEN'S VIEWPOINT
Soc of Auto Engr, NY, J of Auto Engr, v 80 n 7, July 1972, p 76

Construction noise accompanying the rehabilitation of old and the development of new transportation modes is extremely destructive to the quality of life, and the environment. With few exceptions, industry has failed to internalize the cost of muffled equipment and procedures, and the cost of this intense noise exposure is an 'external cost' borne by both the workers and the exposed public. Engine equipment manufacturers, contractors, and project sponsors resist design for quiet. Engineers have an ethical imperative to protect the noise receiver. Citizens demand for quieter construction is growing and a few manufacturers are voluntarily marketing quieter compressors and paving breakers. Government, on all levels, is beginning to raise the question of unlimited noise emissions. The Walsh Healey noise exposure limits are now applicable to construction operations. Industry should be given financial incentives and assistance to expedite the necessary change-over to design and operation for quiet.

Bollman, S. R.
WHAT'S NEW IN AIR DRILLING
Rock Prod, v 75 n 6, June 1962, p 62 and 90

Article discusses novel developments in the design of pneumatic rock drills particularly in areas of: noise-abatement devices; dust-suppression equipment; and sound-conditioning, enclosed cabs.

Graig, H. D.
NOISE FROM AIR COMPRESSORS AND PNEUMATIC TOOLS
Noise Control Vibr Reduct, v 5 n 1, Jan 1974, p 32-35, 37-38

A summary is given of the legal and economic pressures on the manufacturers of air compressors and pneumatic tools as the result of regulations by various city and national governments requiring noise abatement and/or personnel protection from excessive noise. Two case histories are then given to illustrate the type of approach the author's company has taken to the problem. The machines considered are: (1) portable compressors intended for site use both in open country side and in towns; and (2) percussive tools for the drilling of rock, breaking of concrete and for general construction and demolition site use.

Dirdal, B.; Gjaevenes, K.
NOISE FROM COMPRESSORS AND PNEUMATIC EQUIPMENT
Appl Acoust, v 4 n 1, Jan 1971, p 23-34

Test codes for the measurement of the noise from portable compressors, rock drills and paving breakers are discussed. Noise levels for such equipment are reported, and noise criteria for construction works with respect to annoyance are annotated. An appendix quotes Norwegian proposals on test codes for the measurement of noise from compressors and pneumatic equipment. 6 refs.

Gail, C. P.
TUNNEL DRIVEN USING SUBSURFACE FREEZING
Civ Engr (NY), v 42 n 5, May 1972, p 37-40

The freezing method was chosen for a 20 ft diam sewage tunnel on New York's west side. Subsurface freezing utilizes a refrigerated brine solution that circulates through pipes and freezes land barriers surrounding the shaft. The method reduces noise levels and its cost is comparable with other methods. The refrigeration plant froze two sections of tunnel at a time, freezing ground ahead of excavation. Portable drilling rigs sank both the probe and freeze holes.

Gantke, F.; Ihlefeldt, J.; Koch, P.; Tappe, W.
DER HOESCH-LAERMSCHUTZTURM, (HOESCH NOISE ABATEMENT TOWER)
Baumasch Bautech, v 20 n 10, Oct 1973, p 395-400

The Hoesch noise abatement tower has been developed to reduce the noise produced during the driving of sheet piles. During the driving work this tower encloses the driving plant as well as the sheet piles to be driven and thus reduces the diffuse sound propagation. This paper reports the tests and acoustic measurements carried out on various models. 8 refs. In German.

Gatley, W. S.; Barth, M. G.
A PRACTICAL APPROACH TO THE EXHAUST SILENCING OF THE PNEUMATIC ROCK DRILL
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, DC, Oct 4-6, 1972)

Exhaust noise from a medium sized pneumatic rock drill was measured, and a muffler that reduced exhaust noise to an acceptable level with a minimum increase in exhaust back pressure was developed. The prototype muffler had an insertion loss of 22 dB and reduced exhaust noise at the operators ear position of from 115 dBA to 87 dBA. Back pressure developed by the muffler was 0.5 psi, and it cause a 4 percent increase in drilling efficiency. The muffler combined a reactive element (an expansion chamber) with a dissipative element composed of a steel wool liner. The muffler can be used without modification in mining operations where supply air is moisture-free. Preliminary tests indicate that icing does not occur when normal amounts of moisture are present.

Giovanetto, J.; Kacynski, C.
SOUND ATTENUATION AFTER THE FACT
SAE Paper 720751, for Meet, Sept 11-14, 1972,

The noise levels of earthmoving equipment, in the operator's cab and outside the machine, are discussed. Ways and means of lowering the dB ratings for increased operator and bystander comfort are taken into account. Suggestions are made for ways of mounting the cab itself and lessening vibratory reactions from the engine, including rubber engine and cab mounts, plus acoustical material for reducing inside the cab noise.

Harrison, L, (Ed)
NEW EQUIPMENT AND PROCEDURES COPE WITH TOUGHEST NOISE REGULATIONS
Constr Methods Equip, v 54 n 8, Aug 1972, p 40-42

It is shown how rock drilling and piledriving in a highly residential area forced the contractor to adapt his equipment to keep production up, while holding total construction noise at or below that of normal city traffic.

Hornung, J
LAERMARME BAUVERFAHREN AUF INNERSTAEDTISCHEN TIEFBAUSTELLEN - MOEGLICHKEITEN UND ANWENDUNGSBEREICHE, (POSSIBILITIES AND RANGE OF APPLICATION OF THE SILENT CONSTRUCTION METHODS FOR URBAN CONSTRUCTION ENGINEERING)
Baumasch Bautech, v 21 n 3, Mar 1974, p 73-82

The results of noise measurements carried out with different construction engineering methods applied are depicted with due regard to the cost relations. Possibilities are suggested as to how the noise situation on urban construction sites migh be improved. 20 refs. In German with English abstract.

Jensen, J. W.; Visnapuu, A
PROGRESS IN SUPPRESSING THE NOISE OF THE PNEUMATIC ROCK DRILL
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

The development of a prototype quiet pneumatic rock drill is described. The main air valve and the rotation chuck, normally made of tool steel, are made of high damping and Mn-Cu alloys. The drill is encased in a noise suppressing cover that also encloses a reactive muffler for exhaust noise. The standard 48 in. long chisel bit drill steels are modified by addition of constrained layer dampers to suppress resonance noise.

Katzer, M. F.; Conover, H.; Poertner, H. G.; Glasscock, D. L; Muller, J,; Garavaglia, M.; Atkinson, G. L.; Pirtz, J., Jr; Perkins, B. L.; McCarthy, G. T.; Tamagni, J. S.; Beard, G. L.
ECONOMICAL CONSTRUCTION OF CONCRETE DAMS
Econ Constr of Concr Dams, Engr Found Conf, Proc, Pacific Grove, Calif, May 14-18, 1972, 558 p, Publ by ASCE, NY, 1972

Following is a continuation of the list of titles and authors of the papers presented: Control of Turbidity at Construction Sites, by Melvin F. Katzer; Preservation and Restoration of the Landscape, by Herbert S. Conover; Noise Control at Construction Sites, by Herbert G. Poertner; Control of Pollution in Concrete Dam Construction, by Dwight L. Glasscock; Trends in Design and Construction Practice for Concrete Dams, by Jean Muller, Concrete Dam Construction Practices, by Marcello Garavaglia; Panel on Owner-Engineer-ContractorEconomic Considerations in Dam Construction - Viewpoints, by

George H. Atkinson; Cost Reduction Considerations for New Considerations in Dam Construction, by Gerald T. McCarthy; Owner- Engineer-Contractor Economic Considerations in Dam Construction - From the Viewpoint of John S. Tamagni; Owner-Engineer-Contractor Economic Considerations in Dam Construction - Remarks, by George L. Beard; Economic Considerations for Construction, by Joe Pirtz, Jr.

Kessler, F. M.
MEASUREMENT OF CONSTRUCTION SITE NOISE LEVELS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

A procedure for measuring noise levels at construction sites is evaluated. A class II sound level meter is set on 'slow' response-A-weighting network for the first 5 sec of each minute for 30 min. The 'central tendency' of the meter indicator during the 5 sec period is tabulated, and the 'maximum value' of the indicator during a 10 ± 2 sec preiod at the start of each minute is tabulated. Artithmetic averages are computed. The method was tested at four construction sites. It was easily used by the non-acoustician after preliminary instructions. A uniformly noisy construction site whose noise approaches a random distribution allows use of either measurement or averaging techniques to represent the distribution of noise level; the construction site whose noise level distribution is very non-random may cause problems.

Mann, R. L.
REDUCING CONSTRUCTION EQUIPMENT COOLING SYSTEM NOISE TO MEET THE FRENCH NOISE REQUIREMENTS
SAE Prepr 730872, for Meet, April 26, 1973

Major noise source on construction equipment is the cooling system when tested according to the French noise test procedure. This paper describes the procedure and methods used to reduce economically the case 580B CK loader-backhoe cooling system noise to 75 dBA, well below the French limit of 80 dBA for the whole vehicle, and remain within the desired physical and performance constraints. This was accomplished primarily by reducing fan speed and using a larger capacity radiator to maintain adequate cooling.

O'Neill, J. T.
CONTROL OF CONSTRUCTION NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

A performance specification regulating the noise coming from construction sites in New York city is described. The specification sets the allowable sound levels at the residential building nearest the site at 75 dBA for weekdays between 7 and 11 A.M. and at 60 dBA for all other times. The impact of this specification on construction of new subway routes is examined. The contractor for this projetct was able to comply with the specification at a cost of approximately 1 percent of the contract price by utilizing commercially available muffled machinery, by modifying other machines and by carefully positioning noisier pieces of machinery.

Porter, M. A.
ACOUSTIC DESIGN CONSIDERATIONS FOR PRIME MOVER INSTALLATIONS
ASME Paper 73-GT-7, for Meet, Apr 1-4, 1973

Basic acoustic design considerations for gas compressors and other prime movers are discussed. Several sources of noise other than the usual muffler and air intake systems are examined.

Riley, A.
PORTABLE AIR COMPRESSORS INVESTIGATING IN SILENCE AND SAFETY
Fluid Power Intl, v 38 n 4, Apr 1973, p 49

Summary of the results of research and continuous field testing in the range of "whisperized" compressors, all of which give quiet running even at full load. Available "silenced" models range in capacity from 85 C.F.M. to 140, 175, and 240 C.F.M. an examination of the principal features of the DR250SL whisper-flo model. The 250SL is a completely redesigned portable compressor combining the trends in silencing techniques.

Schomer, P. D.
PREDICTING COMMUNITY RESPONSE TO BLAST NOISE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

A preliminary method is given to predict annoyance levels in the envrons of a blasting area. The means are given to scale 0 lb of TNT to 1 lb of TNT; burried charges and above ground detonations are also considered. Various ways to predict probable blast overpressures and spectrum as a function of distance on days exhibiting adverse weather conditions are considered. The annoyance of blast noise is predicted using composite noise rating (CNR) and, for this calculation, the impulsive noise startle correction factor suggested by Kryter is added to the perceived noise level. Blast noise case histories are considered for verification of the prediction method, and the prediction method is suitable for computer computation of equal annoyance contours.

Spivey, D. A.
NOISE ABATEMENT
Military Engr, v 64 n 423, Jan-Feb 1973, p 31-34

Construction activity produces unwanted sound. This noise comes from pneumatic drills, generators, bulldozers, demolition activities, and other sources. Construction noise, as with other forms, is best solved at the source of emission rather than at the receiving end. In the solution of a noise problem the noise level produced at the source must be determined, the noise level criteria at the receiving end must be calculated. Finally, a method must be selected or devised to reduce the noise to acceptable levels. A wide variety of methods and abatement devices are available. The basic factors in the transmission of contruction noise are discussed and include the effects of distance and atmosphere, attenuation provided by barriers and trees, and the effect of direction.

Stephenson N. J.; Thomas, I.D.A.
REDUCTION OF NOISE FROM CONSTRUCTION MACHINES WITH PARTICULAR REFERENCE TO COOLING SYSTEMS
SAE Prepr 730849, for Meet, Sept 10-13, 1973

It has been found that on many conventional construction machines, the cooling system is the major noise source. Design parameters for quiet and efficient cooling systems are explained; they show the importance of matching the various elements of the system. It is illustrated that, in practice, very minor changes to cooling systems to improve the match, coupled with other fundamental noise reduction techniques, can result in considerable reductions in noise. Reference is also made to possible future trends in minimizing cooling system duty by use of new materials to reduce engine heat rejection.

Viksne, A.
MEASUREMENT AND REDUCTION OF NOISE FROM DETONATING CORD USED IN QUARRY BLASTING
U.S. Bureau Mines, Rep Invest 7678, 1972

A series of tests was conducted by the Bureau of Mines to determine the best means of reducing noise generated by the detonating cord that is utilized for trunklines in quarry blasting. The different types of detonating cord were tested and evaluated for their acoustic qualities. The results of the investigation showed that noise levels produced by "low-core-load-per-ft" detonating cord "not covered" were lower than those produced by "high-core-load-per-ft" detonating cord covered with 6 in. of unconsolidated material. 4 refs.

Wayshak, G.
CONSTRUCTION EQUIPMENT NOISE IS ABOVE EAR DAMAGING LEVEL
J of Environ Health, v 35 n 2, Sept-Oct 1973, p 147-151

Measurements of noise levels of construction equipment in operation on the island of Oahu, Hawaii, are reported. All levels were above 90 dBA ear damaging level set by the Occupational Health and Safety Act of 1970. Major types of construction equipment were surveyed. On site equipment consisted of tractor drills, generators, compressors, backhoes, pile drivers, pneumatic extractors, and one shovel sample. Hand operated equipment included concrete busters, electric chipping guns, nail guns, tamping compactors, hand grinders, hand saws, and one chain saw. Stationary power equipment included cut-off saws, table saws, planers, and masonry saws. A large proportion of the surveyed construction workers indicated that they were unaware of the ear protection devices available. The effects of noise on man depend on the type of noise; its intensity, distribution and variability; the duration of individual susceptibility; and prebycusis.

Food and Kindred Products

Anon
INDUSTRIAL NOISE: SWEDEN
British Standards Inst, Tech Help to Exporters, Tech Digest TD 1008, Jan 1973, 14 p

Information on the technical requirements applicable to industrial noise in the environment and as an occupational hazard is presented. This is related to industrial plants and machinery installations, tractors, agricultural machinery, and personal protection in Sweden. Details of the availability of equipment approval and the procedures involved are discussed. Supplementary equipment information sheets are provided; each sheet includes details of the technical and approval requirements for each item of equipment. The statuatory regulations and regulatory organizations of Sweden are outlined.

Bennett, R. T.
UPDATE ON NOISE CONTROL AT INTERNATIONAL HARVESTER
SAE Paper 720720, for Meet, Sept 11-14, 1972

International Harvester has testified to the Environmental Protection Agency about present noise levels and has stated what it considers to be reasonable goals. Noise control work is progressing, especially in the area of environmental noise on lawn and garden equipment and operator noise on larger tractors. The engineering community must take every opportunity to present the case for cost-benefit considerations in noise control.

Chen Y. R.; Huang, B. K.; Suggs, C, W.
NOISE CONTROL BY ACOUSTIC INTERFERENCE
Trans Amer Soc Agri Engr, Gen Ed, v 14 n 3, May-June 1971, p 424-427

Investigation to apply the theory of acoustic interference in reducing the tractor noises in the vicinity of the operator's head position. Field tests indicated that in the lower frequency bands the sound pressure level could be reduced up to 8 dB and that the maximum attenuation of 4 dB was obtained for overall sound pressure level of tractor noise at a seated operator's head position. 8 refs. Paper 70-104. 09301

Cocke, J. G.
NOISE LEVELS IN AGRICULTURAL PROCESSING OPERATIONS
Amer Soc Agric Engr, Paper 72-813 (1972)

Some agricultural processing operations produce noise levels which exceed those recommended by the Occupational Safety and Health Act. Excessive noise has a detrimental effect on health, safety, and the level of productivity. Effective control can be achieved by utlizing currently available materials and techniques.

Crocker, M. J.
NOISE
Agric Engr, v 54 n 4, Apr 1973, p 10-13

Problems associated with the sources of noise in agricultural machinery, how noise can be measured, and how it can be reduced are discussed. Noise reduction methods that can be used with a machine in place are compared.

Emme, J. H.
DESIGN CONSIDERATIONS FOR NOISE INSULATION OF OPERATOR CABS
SAE Paper 720702, for Meet, April 27, 1972

The noise insulation of operator cabs for construction and agricultural equipment has become increasingly important in the last few years. This paper presents a discussion on the noise control design considerations for the basic structure, control levers, and effective sealing. Also discussed are the parameters to consider in the use of absorption and transmission loss materials.

Hartdegen, D. R.; Akins, H. G.
NOISE CONTROL AT THE OPERATOR'S AREA ON LARGE FARM TRACTORS WITH CARS
SAE Prepr 720752, for Meet, Sept 11-14, 1972

There are three main sound contributors, air-borne noise, car vibration, and component radiation. To evaluate any one of these the other two need to be virtually eliminated. The cure for reducing the disturbing noises is to use the tools of isolation, damping, blocking, and absorption. These controls are applied to one source at a time, being sure a change in sound can be properly measured. The third step is to have a realistic goal to reach with each noise reduction.

Melling, T. H.
NOISE IN THE BREWING INDUSTRY — THE SOURCES, ITS CONTROL
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

Noise generated by bottling and kegging lines in the brewery industry is described, and noise reduction methods are described. Noise reduction in the bottling line can be achieved by a combination of absorption into the bottling hall, partial and total enclosure and screening techniques. Stainless steel containers and adequate lubrication of the conveyer system reduces noise in the kegging lines.

Milsted, M. G.; Wegscheid, E. L.
ON THE NOISE REDUCTION OF A RECTANGULAR BOX WITH APPLICATION TO TRACTOR CABS
SAE Prepr 720707, for Meet, Sept 11-14, 1972

The effects of various acoustical treatments on the airborne reduction of a cab-type enclosure can be evaluated rather simply by measuring noise reduction in a diffuse sound field. One of the implications of the study is that the standard tests of acoustical materials (e.g., the Geiger plate test or the impedance tube absorption test) may not be the best guides for estimating the effectiveness of these materials when they are to be used in complicated structures. Because the wavelengths of low frequency modes in tractor cabs are twice the dimensions of such cabs, sloping walls are ineffective as a means for scattering sound. 15 refs.

Polhemus, J.; Edwards, J.
DESIGN OF AN ACOUSTICAL ENCLOSURE FOR A BLANK AND HEMMING MACHINE
Pollut Engr, v 6 n 4, April 1974, p 33-34

The sequence of events described outlines the choice and development of a machine enclosure for the control of noise. A noise survey of the entire facilities was made. The preliminary survey established the relative sound levels (dBA) at different machines and work stations throughout the entire bottle cap manufacturing plant.

Ris, B. H.
TRACTOR NOISE ANALYSIS — OPEN AND ENCLOSED OPERATORS
SAE Paper 720706, for Meet, Sept 11-14, 1972

For tractors without operator enclosures, the noise sources must be located and ranked according to their contribution. A complete analysis of the engine-produced noise level is presented. Enclosing the operator represents a means of controlling the sound level to which he is exposed. Analysis and priority ranking of several methods used to reduce the noise level inside the enclosure is developed.

Splinter, W. E.; Mumgaard, M. L.; Steinbruegge, G. W.; Larsen, L. W.
SOUND LEVEL TESTS OF AGRICULTURAL TRACTORS
SAE Prepr 720719, for Meet, Sept 11-14, 1972

Sound level at the operator station and at a bystander position 7.5 m from the center line of the vehicle has been measured at the Nebraska Tractor Test Laboratory on 67 agricultural tractors. Sound values at 100, 75, and 50 percent drawbar load are reported. Results indicate that farm tractor manufacturers have made significant progress in reducing sound levels to acceptable values. The fact that bystander noise has tended to decrease, despite increasing horsepower, and the fact that two tractors have tested below 90 dBA without cabs indicates that a lot of work has gone into reduction of exhaust noise, engine noise, gear noise, etc. 10 refs.

Stangl, G. A.; Porterfield, J. G.; Lowery, R. L.
TRACTOR EXHAUST NOISE EVALUATION TECHNIQUE
Trans Amer Soc Agric Engr (Gen Ed), v 16 n 4, Jul-Aug 1973, p 601-605

Study to develop a technique to evaluate potential means of reducing exhaust noise. This included determination of the relationship between exhaust system pressure and noise at the exhaust outlet for a standard system and identification of the main contributors to exhaust noise. 9 refs.

SIC 22 - Textile Mill Products

Anon
AATCC SYMPOSIUM ON THE ENVIRONMENT - 1973
Text Ind, v 137 n 8, Aug 1973, p 87.89, 91, 93, 95

The three principal components of industrial pollution - air, water and noise - are surveyed as they affect the manufacturer of textiles. Several papers presented at an AATCC conference are summarized, including those on solvent processing, textile air pollution over Rhode Island, the environmental effect of dyes and solid waste disposal with energy recovery. Finally, an analytical approach to establishing guidelines for noise control is included.

Bailey, J. R.; Brown, C. M.
GUIDELINES FOR TEXTILE INDUSTRY NOISE CONTROL
J Engr Ind, Trans ASME, v 96 Ser B n 1, Feb 1974, p 241-246

Paper 73-TEX-2.

Bruce R. D.; Gubitose, N. F.
NOISE CONTROL FOR A TEXTILE MACHINE
SIV, Sound Vibr, v 5 n 5, May 1971, p 20-24

Following a careful analysis of the noise sources in a textile machine, an enclosure construction of 16-gage sheet metal with vibration damping compound and sound absorptive foam has been designed and constructed for a prototype machine. The equivalent noise level reduction achieved through the utilization of the cover is about 10 dBA. With the enclosure the noise generated at the interface of the spindle whorl and the belt is sufficiently attentuated so that the noise due to the ballooning of the twine and the winding of the bobbins is now the controlling component in the total noise level.

Gudworth, A. L.; Stahl, J. E.
NOISE CONTROL IN THE TEXTILE INDUSTRY
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc (Wash DC, Oct 4-6, 1974)

Noise associated with opening, carding, pickling, and blending are described, and noise control in filament processing (twisting, drawing, spinning, etc) is discussed. The most severe noise problem occurs in cloth production, especially in weaving, braiding, and knitting. Braiding machine noise can be reduced by polyurethane carriers.

Emerson, P. D.; Overman, H. S., III
REDUCTION OF NOISE FROM ROTATING TEXTILE SPINDLES
Amer Ind Hygiene Assoc, Baltimore, J, v 33 n 4, April 1972, p 252-257

Noise levels in textile yarn spinning operations generally exceed 96 dBA Most of this noise is vibration-induced from unbalanced loads concentrated outside of bearing supports and is transmitted to machine frames where it is then radiated to the air. Simple addition of weight to spindle bolsters reduces vibration transmitted to machine frames, but does not affect directly radiated sound from bobbin to package eccentricities. Addition of only a few pounds reduces acceleration levels by an order of magnitude or more, but continued addition produces sharply diminishing effects, implying an asymptomatic relationship. Noises originating from spindle vibration thus can be treated only by interfering with the transmission of vibration to other, larger radiating areas. Noises attributable to eccentric rotation must be treated by reducing eccentricities between spindle and yarn carrier.

Page, J. D.
TEXTILE MACHINE NOISE CONTROL
IEEE Trans Ind Appl,v IA-8 n 4, July-Aug 1972, p 472-476

An approach to noise control by a textile machine manufacturer is outlined. The means of identifying noise sources are discussed. The results of applying some noise reduction techniques are presented. 11 refs.

Lumber and Wood Products -

Lamb, F. M.
INDUSTRIAL NOISE AND NOISE EXPOSURE
Forest Prod J, v 21 n 9, Sept 1971, p 84-87

General review is presented of the problems of industrial noise including a summary of thw Walsh-Healey Act and its effect on the wood working industry. Noise is defined as unwanted sound or sound that is capable of degrading or damaging some human quality. Excessive noise exposure is considered to be a noise level of over 90 dBA. Many of the typical machining operations in wood-working produce a noise level in excess of 90 dBA. 10 refs.

Malcom, F. B.
SLITTING SAWBLADES CUTS NOISE
Wood & Wood Prod, v 76 n 3, Mar 1971, p 46-47

A simple, effective means of reducing the high-frequency screaming sound in circular saws has been developed by G. Pahlitzsch and B. Rowinski, Institut fur Schleif und Poliertechnik, Braunschweig, West Germany. The method involves cutting four symmetrically placed expansion slots in the rim of the sawblade. The depth (length) of the slots must be at least one-sixteenth of the radius of the saw.

Smith, J. H.
NOISE IN WOODWORKING INDUSTRY: A REVIEW OF THE LITERAURE
Forest Prod J, v 21 n 9, Sept 1971, p 82-83

A review is presented of information and literature selected as being pertinent to the measurement and control of noise pollution in the woodworking industry. 27 refs.

Stewart, J. S.; Hart, F. D.
ANALYSIS AND CONTROL OF WOOD PLANER NOISE
SIV, Sound Vibr, v 6 n 3, Mar 1972, p 24-27

The causes of wood planer noise are analyzed and possible means of noise control are outlined. The sources of noise generation and a discussion of the factors influencing the radiation of sound are considered. Finally, possible solutions including mechanical redesign of new machines and short-term solutions applicable to existing machines are presented.

Stewart, J. S.; Hart, F. D.
WORKPIECE VIBRATION CONTROL IN WOOD PLANERS
ASME Paper 73-DET-79, for Meet, Sept 9-12, 1973

The use of workpiece vibration suppression to help control industrial wood planer noise is explored. Laboratory experiments which simulate workpiece excitation and suppression are described. Utilizing the suppression system on an industrial machine in conjunction with a cutter head equipped with spiral knives and a compact enclosure provides a reduction in noise level of about 20 dB.

Thompson, S. E.
CHAIN SAW SAFETY, VIBRATION, AND NOISE
SAE Prepr 730702, for Meet, Aug 20-23, 1973

The chain waw designer tries to protect the logger from three main hazards: cuts and bruises, vibration injury, and hearing impairment. Each of these problems is examined in terms of severity and solution. The availability of field data, as they affect the writing of safety standards and regulations, are also examined. Progress is being made. Chain brakes and special chains have been introduced in an attempt to solve the kickback problem. A number of units meet most existing European vibration standards. Noise levels are still higher than desirable on most models, but muffler development is beginning to reduce exhaust noise toward mechanical noise levels. 14 refs.

Wilson, J. L.
CHAINSAW NOISE. A SERIOUS HEALTH HAZARD
N Z Engr, v 26 n 10, Oct 1971, p 298-302

An investigation into the problem of the noise emitted by chain saws used in the forest industry. An attempt is made to relate sound theory, noise legislation, available research information and the operational data obtained on chain saw use. Sections on the measurement of chain saw noise and the methods of protecting chain saw operators from noise are included.

Furniture and Fixtures -

Lyons, D. W.; Hatcher, J. D.
NOISE CONTROL FOR THE PROCESS INDUSTRIES
Instru in the Pulp and Paper ind, v 12, Proc 12th Intl ISA Symp, Lancaster, Pa, May 3-7, 1971, ISA, p 22-26

A noise hazard is described as a noise level to which employees are exposed which results in a frequency dependent hearing loss. The incentives for an employer to develop a noise control program are discussed in detail and related to the guidelines and enforcement powers of the Labor Department as stipulated in the Occupational Safety and Health Act of

1970. A noise control program is presented which contains five procedures. Each of these procedures is discussed and the overall program is shown to provide, if effectively managed, protection for both the employee and the employer. 2 refs.

Reisch, K. E.
CAST-NYLON GEARS CUT NOISE, BOOST SPEED IN PAPER MILL
Power Transm Des, v 13 n 8, Aug 1971, p 41-43

Monomer casting permits nylon gears with diameters far greater than the 12 in. limitation of the older injection-molding process. Applications in a paper mill and in a power station are described.

Scheer, R. C.; Ostendorf, R. G.; Shuler, B. F.
NOISE REDUCTION TECHNIQUES FOR PAPER CONVERTING MACHINERY
TAPPI, v 56 n 6, June 1973, p 65-68

One-third and one-tenth octave band sound measurements were used to identify and isolate individual noise sources in several pieces of paper converting machinery. High-speed spur gears contribured noise both from tooth contact and ringing. Hollow steel rolls and cylinders also were found to be ringing. Perforator blade vibration (like a tuning fork) was a major source that is easily controlled. Noise control techniques used included: dampening of gears, rolls and cylinders; and perforator blades.

Van Derveer, P. D.; Sullivan, M. D.
NOISE CONTROL: A GROWING ENGINEERING CONCERN
Pulp & Paper, San Francisco, v 46 n 1, Jan 1972, p 70

A review of papers presented at the American Pulp and Paper Industry Engineering Conference of November 1971, is presented. The medical aspects of noise including the difficulties of standards setting and techniques of noise control in pulp and paper related industries were among the topics covered.

Chemical and Allied Products -

Again, T. C.; Morton, W. R.
NOISE CONSIDERATIONS ON LARGE PROCESS UNIT DRIVERS
IEEE Pet and Chem Ind Conf, 20th, Annu, Conf Rec, Houston, Tex, Sept 10-12 1973, Paper 73-8, p 69-80, Available from IEEE (73CH0769-01A), NY, 1973

This paper is directed toward in-plant noise produced by large process drivers (1000 HP and larger) in refineries and chemical plants. More specifically, this paper considers the typical noise produced by large electric motors, gas turbines and steam turbines. Gears are also discussed since they are frequently used with motors and gas turbines to attain the proper speed for the large compressors. The discussion considers such things as: the factors which contribute to noise; typical noise levels; various methods of reducing noise; & effects of plant and installation variables.

Allen, L. L.
AERODYNAMIC CONTROL OF VALVE NOISE
Pollut Engr, v 5 n 10, Oct 1973, p 34-36

Two methods reviewed were employed to minimize the operating noise level of a control valve. One is to reduce noise after it has been generated by the control valve; the other is to minimize noise generated within the valve.

Allen, E. E.
CONTROL VALVE AND REGULATION NOISE ABATEMENT
Gas (Philadelphia), v 46 n 10, Oct 1970, p 58-63

This article presents results of a two-year comprehensive study of valve noise that culminated in development of a simple and accurate technique for predicting ambient noise levels generated by valves controlling the flow of compressible fluids. A brief review of basic acoustic terminology and description of test facilities preface the subject materials.

Allen, L. L.
CONTROLLING ON-STREAM VALVE NOISE - 2
Control Engr, v 20 n 1, Jan 1973, p 44-45

In a sequel to the previous treatment of hydrodynamic noise in control valves (Sept '72), the author notes that when the fluid that is handled is compressible, noise generation occurs in the pressure recovery region immediately downstream from the vena contracta of the valve. Expansion of the gas or vapor at this point causes abrupt deceleration of the stream, accompanied by a turbulence whose byproduct is a high sound pressure level. This article focuses on suppression of aerodynamic valve noise.

Allen, E. E.
HOW TO CONTROL NOISE IN INDUSTRIAL VALVES
Actual Specif Engr, v 30 n 3, Sept 1973, p 107-111

The author gives a detailed description of the mechanisms of noise generation by fluid flow through control valves and how noise can be controlled.

Anon
NOISE AND CONTROL VALVES
Compressed Air, v 78 n 4, Apr 1973, p 8-12

Solutions to problems of valve noise reduction obtained in an extensive test program within its R.S. Engel Technical Center at Marshalltown, Iowa. Solutions offer noise prediction techniques for both aerodynamic and hydrodynamic flow, two styles of quiet trim, complementary valve bodies for noise applications, silencers, and in-line diffusers.

Anon
TAMING NOISY FEEDERS
Automa (Cleveland), v 18 n 7, July 1971, p 55-56

Noise levels in vibratory feeding can be reduced by using cast bowls, bowl liners and coatings, enclosures, and massive base supports.

Arant, J. B.
HOW TO COPE WITH CONTROL VALVE NOISE
Instrum Technol, v 20 n 3, Mar 1973, p 37-43

Noise in and around control valves is examined with regard to sources of and solutions to the problem. With emphasis on applications, practicality and economics, the author reviews the value of different diffusers, silencers and special valve designs in the reduction of aerodynamic noise. 12 refs.

Braumann, H. D.
CONTROL VALVE SOUND PRESSURE LEVEL PREDICTION
Instrum Contr Syst, v 44 n 4, Apr 1971, p 93-97

10 refs.

Boger, H. W.
DESIGNING VALVES AND DOWNSTREAM DEVICES AS LOW NOISE PACKAGES
Heat, Piping Air Cond, v 43 n 10, Oct 1971, p 82-86

How valve noise up to 10 dB above set limits can be cured by increased pipe wall thickness or acoustic insulation. It is shown that greater noise requires downstream silencers or expansion plates. The effectiveness of the expansion plate is shown by test results, and a graphic noise estimation method is featured.

Brennan, J. R.
CAUSES AND CURES - CONTROLLING NOISE IN FLUID PUMPING SYSTEMS
Plant Engr, (Barrington, Ill), v 28 n 4, Feb 21, 1974, p 89-93

Primary sources of noise are mechanically generated (driver, pump, vibration due to loose or worn bearings and couplings, etc.) or hydraulically generated (cavitation and aeration). Low speeds should be used for pumps with a high number of closures to reduce noise. Installing a muffler, accumulator or desurger in the discharge line, will suppress pulsations from gear pumps.

Briffa, F.E.J.; Clark, C. J.; Williams, G. T.
COMBUSTION NOISE
Combustion, v 45 n 9, Mar 1974, p 27-37

The paper initially considers the generation of noise from free flames. The mechanism of noise generations, its location, and the characteristics of the sound pressure field and frequency spectrum are described. The effect of gas velocity, burner diameter, fuel to air ratio and assisted stabilization on the sound pressure and radiation efficiency are also examined. 41 refs.

Briffa, F.E.J.; Clark, C. J,; Williams, G. T.
CUMBUSTION NOISE
J Inst Fuel, v 46 n 386, May 1973, p 207-216

The mechanism of noise generation, its location, and the characteristics of the sound pressure field and frequency spectrum are discussed. The effect of gas velocity, burner diameter, fuel to air ratio and assisted stabilization on the sound pressure level and radiation efficiency are examined. Where possible, comparisons are made with the corresponding behavior of nonburning jets. The paper goes on to consider the effects on noise generation of interaction between the combustion process and its surroundings. The paper covers methods for both reducing the broad band noise from free flames and elminating resonances as they occur in enclosed flame systems. 41 refs.

Bruggink, R. H.; Shadley, J. R.
A WORKABLE FURNACE NOISE CONTROL PROGRAM
Chem Engr Progress, v 69 n 10, Oct 1973, p 56-59

Significant reduction in process heater noise can be attained by enclosing the base and installing silencers on the combustion air openings. The technique was successfully applied by Clark Oil and Refining Corp. at its Blue Island, Illinois refinery. The enclosure was neither unsafe nor a hindrance to normal operaions and maintenance. Approximate cost of the program was $127,000. The low-to-mid frequency sounds produced by the combustion process often violated community noise codes and could be severely annoying. Good noise reduction was achieved by the base enclosure and silencer system, resulting in favorable responses from employees and the community.

Butler, P.
PREDICTION IS THE KEY TO REDUCING NOISE FROM CONTROL VALVES
Process Engr, Feb 1973, p 88-89

A technique is presented for predicting noise generated by globe valves. It is shown that in light of current legislation, noise reduction could be achieved by using a modified valve trim, by installing a diffuser downstream of the control valve, or by fitting an in-line silencer.

Butterfield, A. W.
COMMENT LUTTER CONTRE LE BRUIT PRODUIT PAR LES VANNES DE REGLAGE (ABATEMENT OF NOISE GENERATED BY CONTROL VALVES)
Ingenieursblad, v 41 n 22, Nov 16, 1972, p 661-668

Noise in control valves is shown to be generated by any of the following causes: mechanical vibration of inside moving components, cavitation of liquids, or aerodynamic turbulence. Using two parameters defining the control valves, it is possible to calculate both cavitation noise and aerodynamic turbulence. A simple method based on graphs and tables is proposed which makes it possible to calculate aerodynamic noise with a high precision. The features of special commercially available anticavitation and antinoise valves are discussed.

Cahill, L. B.
DEFINING PLANT NOISE PROBLEMS
Chem Engr Progress, v 69 n 10, Oct 1973, p 65-66

A systematic method to define specific plant noise problems is summarized. Process units are ranked in order of treatment requirements, based on community and in-plant noise surveys. The method includes measurement of noise levels, identification of noisy equipment, comparison of measurements with local criteria using standard acoustical correlation for data reduction, and process unit ranking .

Casciato, A.
CONTROLLING ON-STREAM VALVE NOISE
Control Engr, v 19 n 9, Sept 1972, p 42-44

Process valves that control the flow of liquids and gases produce noise which is at times of such magnitude that new control techniques must be applied to prevent impairment of health and productivity. Since the solutions to liquid and gas flow noise differ so widely, the problems must be tackled separately. The article deals with hydrodynamic (liquid flow) noise and shows how to analyze the process configuration so as to predict in dB the amount of noise reduction that can be attained.

Casciato, A. C.
HYDRODYNAMIC CONTROL OF VALVE NOISE
Pollut Engr, v 5 n 9, Sept 1973, p 41-43

Noise from noncavitating liquid flow, cavitating liquid flow, and flashing liquid flow are dealt with. Laboratory testing and field experience show that noncavitating and flashing flow noise levels are quite low and generally not a problem.

Casciato, A. C.
HYDRODYNAMIC CONTROL VALVE NOISE: PREDICTION, TREATMENT TECHNIQUES
Heat, Piping Air Cond, v 45 n 4, Apr 1973, p 76-80

The mechanics of cavitation, the major source of noise created by incompressible fluid flow through a control valve; a method of predicting valve noise; and relative effectiveness and economy of treatment techniques.

Caserta, L. V.
NOISE ABATEMENT IN AMMONIA PLANTS
Chem Engr Prog, v 68 n 5, May 1972, p 41-42

A case-history description of a noise abatement campaign at the American Oil Co., refinery at Texas City, Texas. In addition to considerations involving the proper design of equipment, the article describes various protective devices such as ear muffs and ear plugs.

Cormack, A. D.
NOISE REDUCTION IN STOCK-PREPARATION MACHINERY
TAPPI, v 56 n 6, June 1973, p 60-64

Where possible, noise reduction should be made at the noise source. On a disk refiner this means a change in the pattern of the refiner disks. This change affects fiber characteristics and, therefore, may not be permissible. By measuring the sound pressure level in an area where a high noise level exists, one can determine whether the noise characteristics reveal a free or a diffused field. In a free field, the noise level is reduced by 6 dB for each doubling of the distance from the noise source. Where the noise level cannot be reduced at its source, an enclosure can be made for either the machine or the operator. Various types of enclosures are discussed.

Cummings, A.
COMBUSTION NOISE
Build Serv Engr, v 41, Sept 1973, p 123-132

The general nature of combustion-generated noise is described. Combustion noise is categorized into two types. The first of these is turbulent combustion noise, which arises from more or less random turbulent fluctations in a flame reaction zone. The second is periodic oscillation, which can stem from inherent system instability, such as occurs in control systems, or from pulsations in air and fuel supplies. Each of these types is dealt with in turn, beginning with a description of the noise generating mechanism. 21 refs.

Deeprose, W. M.; McNulty, P. J.
CAVITATION NOISE IN PROCESS PUMPS
Chem Process Engr, v 53 n 5, May 1972, p 46-48

By using high-frequency transducers to detect increases in the noise level of pumps, the occurance of cavitation can be pinpointed precisely. This technique could provide criteria permitting the design of truly noncavitating pumps. 5 refs.

Diehl, G. M.
COMPRESSOR SOUND CONTROL
TAPPI, v 57 n 4, Apr 1974, p 75-77

The best way to reduce centrifugal compressor noise is to do it at the source. The design engineer can control some of the important noise-generating factors, such as impeller-diffuser distance, number of stages, and sometimes speed. He has no control over other parameters, such as horsepower, molecular weight of gas, and mass flow. If additional noise reduction is required, he must then include external sound control methods. By combinations of sound absorption, sound isolation, vibration isolation, and vibration damping, compressor noise can be reduced to acceptable levels.

Fahy, F. J.; Fisher, M. J.; Lush, P. A.; Briffa, F.E.J.; Cummings, A.; Hanby, V. I.; Leventhall, H. G.; Roberts, J. P.; Nairne, P. J.; Taylor, R. L.; Gordon, C. G.; Ratcliffe, K.; Freeman, C. W.; Underwood, P.C.W.; Sutton, P.
NOISE AND THE INDUSTRIAL USE OF FUEL
Noise and the Ind Use of Fuel, Papers Presented at Symp, Southampton, England, Jan 7 1972 by Inst of Fuel, South Coast, and Inst of Sound and Vibr Res Inst of Fuel, London, England, 1972, Various p

Twelve papers were presented at the conference dealing with the subject of noise due to combustion in machinery or environment, such as furnaces, gas turbines, petrochemical plants, boilers, and reciprocating engines. Noise theory, aerodynamic sources of sound and basic techniques of noise control are also discussed. Following is a list of titles and authors. Applied Noise Theory by F. J. Fahy; Review of Aerodynamic Sources of Sound by M. J. Fisher and P. A. Lush; Combustion Noise by F.E.J. Briffa; Turbulent Combustion Noise by A. Cummings; The Suppression of Combustion-Driven Organ Pipe Resonance, by V. I. Hanby; Some Applications of Correlation Techniques to Combustion Noise Studies by H. G. Leventhall and J. P. Roberts; Acoustic Environment of Boilers by P. J. Nairne and R. L. Taylor; Basic Techniques of Noise Control by C. G. Gordon; Reciprocating Engine Noise by K. Ratcliffe; Industrial Gas Turbine Noise by C. W. Freeman; Furnace Noise by P.C.W. Underwood; Noise Control in Petrochemical Plant by P. Sutton.

Grashof, M.
SICHERHEITSVENTILE IM APPARATEBAU (SAFETY VALVES IN CHEMICAL PLANTS: TYPES: DESIGN FOR FIRE FIGHTING: PRECALCULATION OF NOISE EMISSION AND ABATEMENT)
Chem-Ing-Tech, v 45 n 11, June 1973, p 784-789

Two devices are considered in particular: safety relief valves and safety valves. Spring-loaded safety valves characterized by rapid full opening are mostly installed in process plants where leakages are to be avoided. Leakproof and pilot operated devices are advantageous. Relief requirements for vessel and piping exposure to naked flames are not always necessary except in special cases for liquified gases and inflammable compressed gases. Supersonic velocities in narrow cross sections cause maximum noise levels. Noise abatement is usually not required as most safety valves never blow off. In cases where silencers and manifold pipes are provided for large safety valves, special care must be taken with regard to their reliability. 17 refs. In German.

Gupta, A. K.; Syred, N.; Beer, J. M.
DIE VERMIDERUNG DER SCHALLABSTRAHLUNG VON DRALLBRENNKAMMERN DURCH SUFENWEISE VERBRENNUG (REDUCTION OF SOUND EMISSION FROM SWIRL COMBUSTION CHAMBERS BY PROGRESSIVE COMBUSTION)
Gas Werme Intl, v 23 n 2, Feb 1972, p 39-45

This paper deals with the phenomenon of sound emission from flames occurring in swirl combustion chambers. It is shown that the noise level can be reduced by arranging for a second flame outside the region of major pressure fluctuations. The noise emitted by different flames was investigated in a reverberating chamber. It was shown that by progressive combustion the pressure level was reduced by about 4 dB. In the case of flames with only axial or tangential fuel admission, the maximum of the pressure fluctuations was distinctly outside the flame boundary. 15 refs. In German with English abstr.

Gupta, A. K.; Syred, N.; Beer, J. M.
LOW-NOISE BURNER FOR SWIRL-STABILIZED NATURAL GAS FLAMES
J Inst Fuel, v 46 n 384, Mar 1973, p 119-123

The acoustic energy released by swirl stabilized natural gas flames is studied and the noise characteristics for a given swirl burner geometry, varying flow rates, mixture ratios, and modes of fuel injection are described. Measurements were made of the noise generated by diffusion-type open turbulent swirling flames. It is shown that by a suitable combination of axial and radial fuel injection into the swirl combustor, a short intense flame of good stability with some 4 dB reduced emission of noise can be obtained. The use of a convergent-divergent exit nozzle leads to a significant increase in noise level. 10 refs.

Heller, H. H.; Windall, S. E.
ROLE OF FLUCTUATING FORCES IN THE GENERATION OF COMPRESSOR NOISE
NASA Contract Rep CR-2012, May 1972

This report describes the results of a theoretical and expterimental study on the role of aerodynamically-induced fluctuating forces in the sound generation by axial-flow compressors. Analytical models for the generation and radiation of sound by rotor/stator combinations are developed. For the experimental substantiation of the analytical results, the technology is developed to measure fluctuating forces directly on rotating airfoils using miniature differential-pressure sensors and FM telemetry. Under the assumption of full coherence of the force field on the blade, radiated sound power was predicted from the force measurements on blades and compared with measured sound power. Both broadband radiation from a single rotating airfoil and discrete-frequency radiation due to interaction of multi-bladed stator/rotor configurations were investigated. The results indicate the necessity to obtain information on the details of the force field for accurate prediction of the radiated sound spectrum.

Hill, V. H.
NOISE CONTROL OF HIGH VOLUME GAS HANDLING PLANTS
Amer Ind Hygiene Conf, (San Francisco, Calif, May 14-19, 1972)

Case histories of noise problems associated with such plants as are common in the manufacture of ethylene and ammonia, are presented. The following sources are included: centrifugal compressors, piping, turbine, electric motor, gears, pressure valves, vent mufflers, and oil gas burners.

Hynes, K. M.
DEVELOPMENT OF A LOW-NOISE CONSTANT AREA THROTTLING DEVICE
ISA Trans, v 10 n 4, 1971, p 416-421

A comprehensive study to determine an effective and practical approach to reducing aerodynamic valve noise resulted in the development of a fixed area, throttling device designed to reduce the production of aerodynamic noise at its source. This paper contains an analysis of valve noise and investigates the parameters affecting noise through a series of qualitative tests. The influence of effective orifice diameter, system energy losses, resonant damping, and pressure drop variations are discussed. These factors, when properly incorporated in the finished product, result in a substantial and predictable noise reduction. Test results indicate excellent agreement with predicted SPL values. 4 refs.

Kurikawa, H.; Muta, S.; Nakazono, S.
MECHANICAL SEAL AND NOISE OF CIRCULATING PUMP
Natl Tech Rep, v 17 n 2, Apr 1971, p 166-176

The mechanical seals of circulating pumps for central heating systems, wear, and are noisy. A new seal-ring, made of hard carbon molded with phenol resin sand has been used with organic acid water treatment solutions. In this way, lengthening the life of the mechanical seal is accomplished, and an analysis of pump noise caused by cavitation, electromagnetic noise, bearings, draft, etc. has been made and countermeasures have been taken to solve noise problems. In Japanese with English abstr.

Lenze, B.; Pauls, D.
DIE ENTSTEHUNG UND BEKAEMPFUNG VON BRENNERGERAEUSCHEN (OCCURRENCE AND ABATEMENT OF NOISE IN GAS BURNERS)
Gas Wasserfach, Gas Erdgas, v 115 n 2, Feb 1974, p 48-54

Paper reviews briefly the properties of noise sources such as mono-, di-, and quardrupolar. Sources of noise can be: aerodynamic and combustion noise; as well as vibrations and noise caused by the instability of the flames that can produce resonance phenomena in fire boxes. Dependance of sonic pressure of the premixed and diffusion flames on the inlet parameters is shown. Occurrence of the instable flames is described and it is shown on a practical example to what extent it is possible to assess the resonances from the boiler, and chimney end in order to predetermine the interaction between burner and firing installation. 16 refs. In German.

Loesch,, W.
PROBLEME DER SCHALLDAEMPFUNG BEI VERBRENNUNGSPROZESSEN (NOISE ABATEMENT FROM COMBUSTION PROCESSES)
Gas Waerme Intl, v 23 n 2, Feb 1974, p 45-49

The study of noise generation causes in furnaces and other internal combustion equipment is presented. Compressor noise is dealt separately from combustion noise during the investigation to find a more efficient method in minimization of noise. The interrelationship between the output rating and noise generation is investigated and results presented. In German with English abstr.

Lou, S. C.
NOISE-CONTROL DESIGN FOR PROCESS PLANTS
Chem Engr, v 80 n 27, Nov 26, 1973, p 77-82

Many nations have promulgated laws and regulations in the last decade or so to comtrol noise. In the United States an important provision of the Occupational Safety and Health Act is the protection of the hearing of industrial workers. The Federal Noise Control Act of 1972 extended the regulation of noise to other areas and new legislation is being written at all levels of government. Noise design criteria, allowable noise levels, noise specifications, noise surveys, field abatement, and noise control economics are discussed.

Maroney, G. E.; Elliott, L. R.
HYDRAULIC AND MECHANICAL FACTORS AFFECTING PUMP AIRBORNE NOISE MEASUREMENTS
SAE Prepr 730874, for Meet, Jan 25, 1973

This paper describes the major hydraulic and mechanical factors that affect the measurement of pump airborne noise. Experimental data are presented to illustrate the variation that can result due to such factors as the pump mount, fluid lines, and the drive shaft. Techniques for reducing the variation due to these factors are presented for the reader's consideration.

McCutcheon, E. B.
CAUSES AND CORRECTION OF CONTROL VALVE NOISE
Plant Engr, (Barrington, Ill), v 26 n 6, Apr 6, 1972, p 84-86

When predicting noise levels and designing for noise control, system parameters such as flow rates and pressure drops must be specified. Higher flow rates and pressure drops than will ever be encountered, or encountered merely once or twice a year, may be necessary for sizing control valves, but such a practice can be extremely uneconomical. Deciding under what conditions the valve will operate most of the time will involve some judgment, but concentration on accuracy and realism will avoid overengineering the noise control equipment.

McGinnis, W. E.
CONTROL VALVE NOISE - TREAT THE SOURCE OR THE PATH
Oil Gas J, v 71 n 16, Apr 16, 1973, p 126-132

The very function of valves in controlling fluids can create noise. Basic approaches to control noise are source and path treatment.

Messina, J. P.
PERIODIC NOISE IN CIRCULATING WATER PUMPS TRACED TO UNDERWATER VORTICES AT INLET
Power, v 115 n 9, Sept 1971, p 70-71

It is shown how the noise problem of two 60 in. pumps circulating condenser water in a nuclear generating station was solved by studying an intake model.

Middleton, A. H.; Seebold, J. G.
PROPAGATION OF MACHINE GENERATED SOUND WITHIN AND AROUND A PROCESS PLANT
INter-Noise 72. Intl Conf on Noise Control Engr, Proc (Wash DC, Oct 4-6, 1972)

The way in which sound traveled through a refinery in Feluy, Belgium, was determined, along with the amount of attenuation the sound suffered during traveling. Measurements were made in conditions of little wind, before plant start-up, and at a time when the plant was substantially complete.

A broadband continuous noise source and an impulsive noise source were used. Total amount of attenuation suffered was that due to presence of the plant and that due to hemispherical propagation and atmospheric absorption. Excess attenuation is considered.

Middleton, A. H.
UNDERSTANDING PROCESS PLANT NOISE
Meas Control, v 6 n 2, Feb 1973, p 53-55

The noise from process plants is inevitably complex as a result of the wide variety of machines and operations taking place, each of which produces noise with its own characteristic frequency spectrum. The problems resulting from the noise can be grouped into two categories, community noise and in-plant noise. Community noise is a problem of nuisance, whereas in-plant noise is a problem of permanent hearing damage. The noise control measures required for the two types of noise can be quite different and the information required to assess the problems can also be different. After explaining the concept of sound power level, the author discusses how the sound reaches the community. What makes a sound annoying is also explained. The problem of in-plant noise is considered. Sources of plant noise and their control are then discussed. 8 refs.

Muir, A. J.
SONIC GAS COOLING CUTS POLLUTION CONTROL COSTS
Engr Mining J, v 174 n 8, Aug 1973, p 71-73

Evaporative cooling of hot gases using fine water sprays is discussed and related to the gas conditioning requirements of electrostatic precipitators and bag collectors. A computer study analyses the effect of water atomization on cooling efficiency and provides graphs for use in designing gas cooling systems. Compressed air-driven sonic atomizing nozzles are described and a case history on their use to cool gases from a fluidized bed ore roaster is presented.

Nugent, R.
CONTROL-VALVE NOISE YIELDS TO RESEARCH
Power, v 117 n 7, Jul 1973, p 69-71

The demands for higher pressure drops along the quieter valves in liquid and gas flow are met by analysis and large-scale tests.

Nugent, R. E.
QUIETING NOISY VALVES
Automation (Cleveland), v 20 n 8, Aug 1973, p 40-43

A major source of noise pollution in chemical plants is the noise generated by valves which control the flow of fluids. Techniques for estimating noise levels are presented, and various methods for reducing or eliminating the noise are discussed.

Putnam, A. A.
COMBUSTION NOISE IN INDUSTRY AND ITS CONTROL
Fuels Util Conf, Proc, Cleveland State Univ, Ohio, Oct 26, 1972, p 137-158, Available from Cleveland State Univ, Div of Contin Educ, Ohio, 1972

Types of combustion noise are combustion-driven oscillations, combustion roar, and unstable combustion. After eliminating the occasional combustion-driven oscillations, the unstable flames, and the oft-confused jet noise and flow noise, there remains a basic combustion roar associated with a given intensity of combustion and thermal output. Aside from configuration modifications and decreasing combustion intensity, muffling systems are the only practical method for attenuating combustion roar. 18 refs.

Quinn, T. J.
CONTROLLING CENTRIGUGAL COMPRESSOR NOISE
Plant Engr, (Barrington, Ill), v 28 n 7, Apr 4, 1974, p 111-113

Initially, the sound pressure levels at various positions around the compressor and at various load operating conditions, should be measured with a microphone and sound meter. To reduce compressor air-end noise compressed air piping and, sometimes, intercoolers, aftercoolers, separators and similar piping components, should be insulated. Compressors with by-pass air discharge lines should be equipped with mufflers. Guidelines are also included for noise suppression of mechanical drives, pumps, etc.

Reethof, G.; Karvelis, A. V.
CONTROL VALVE NOISE AND ITS REDUCTION. STATE OF THE ART
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

Monopole, dipole and quadrupole sources of noise in valves with compressible fluid flow are described, and the theory of aerodynamic sound is reviewed. The effects of sound generated within a pipe by orifice type jets, separated regions of flow and pseudosound at the walls are also considered. Valve noise prediction methods such as the Fisher and Masoneilan methods are analyzed. Source treatment procedures for noise reduction are also examined, including multiple series expansion, multiple parallel expansion and torturous path disc stack. Two basic approaches to noise reduction can be used: noise can be reduced at the valve or noise produced by the valve can be absorbed in its path away from the valve.

Rice, G. E.
CONTROL VALVE NOISE PREDICTION AND ATTENUATION
Instru Maintenance Mgt, v 6, Proc, 6th Intl ISA Symp, Apr 26-28, 1971, ISA, 1971, p 56-62

New techniques for accurate noise prediction and methods for attenuating this noise, generated by control valves handling compressibe fluids.

Roberts, J. P.; Leventhall, H. G.
NOISE SOURCES IN TURBULENT GASEOUS PREMIXED FLAMES
Appl Acoust, v 6 n 4, Oct 1973, p 301-308

The relationship between mixture flow paramters and the combustion noise from open turbulent premixed gaseous flames is investigated experimentally, and it is shown how the overall noise levels and frequency spectra are related to certain flow and geometric parameters and to the turbulence structure of the combustible mixture. 13 refs.

Schibbery, H.
DER STAND DER TECHNISCHEN ENTWICKLUNG DES SCHRAUBENVERDICHTERS UND SEINE GERAEUSCHPROBLEME (PRESENT STATUS OF THE SCREW COMPRESSOR AND ITS NOISE PROBLEMS)
Gas Waerme Intl, v 22 n 11, Nov 1973, p 431-434

The latest development in design of screw compressors are reported. They combine the principles of piston compressors with high speed and space economy of rotary compressors. The major application of these compressors is in the gas supply network stations because of their low costs for maintenance and operation. In German with English abstr.

Schuder, C. B.
CONTROL VALVE NOISE -- PREDICTION AND ABATEMENT
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

Control valves, which modulate fluid flow for the purpose of controlling flow, pressure, level, temperature, or other process variables, are major contributors to industrial noise, and some installations in residential areas are also a common source of complaints. Over the past two years, major research efforts have been directed toward the prediction and abatement of the noise produced by the flow of compressible fluids through valves. A fast, accurate noise prediction technique has been developed. Noise abatement technology in the area of "path" treatment has not improved materially although absorption type silencers continue to provide solutions for many valve noise problems. Research in the area of "source" treatment has been quite productive and a number of "quiet" control valves are currently available.

Seebold, J. G.
COMBUSTION NOISE AND ITS CONTROL IN PROCESS PLANT FURNACES
ASME Paper 71-PET-6, for Meet, Sept 19-23, 1971

Intense noise accompaines the high rates of heat release inside process plant furnaces. Combustion noise escapes from the firebox mainly through air registers. To reduce furnace noise effectively, escape of combustion noise from the firebox is prevented. Other design alternatives lack practicality, effectiveness, or both. In natural draft furnaces, escape of combustion noise is prevented by enclosing the burners in acoustically treated air-intake plenums. 20 refs.

Seebold, J. G.
HOW TO REDUCE CONTROL VALVE AND FURNACE COMBUSTION NOISE
Hydrocarbon Process, v 51 n 3, Mar 1972, p 97-100

Piping system noise comes mostly from control valves and high-speed macines. A solution is the selection of special, quiet, valve designs that change the internal physics of pressure reduction, or piping system treatment to prevent noise propagation. The following topics are detailed -- piping flow noise; valve noise propagation; furnace combustion noise; fuel pressure at burners; number of burners; firebox size; external treatment; and plenum design. It is shown that quiet control valve designs, inline silencers, or vibration isolation will reduce piping noise. Furnace combustion roar can be reduced with plenums. 11 refs.

Seebold, J. G.
NOISE CONTROL IN OUTDOOR PROCESS PLANTS. GENERAL DESIGN CONSIDERATIONS AND SPECIAL PROBLEMS
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

Wider understanding, acceptance and application of available technology, and further technological development are needed to assure the design of industrial plants that are adequately quiet from the start. Sources contributing to the composite noise levels are discussed including furnaces, air-cooled heat exchangers, motors, valves, turbomachinery, piping systems, and flares. To satisfy a given composite noise level criteria, usually a variety of combinations of source noise reduction can be considered. For each source, some noise reduction can usually be achieved by several different means, each having its own effectiveness and cost. The need for a systems approach is emphasized and areas of further development are identified.

Seebold, J. G.
RESONANCE IN CENTRIFUGAL COMPRESSOR PIPING
Oil Gas J, v 70 n 49, Dec 4, 1972, p 73-74

Noise can be aggravated by resonance of blade-passing frequencies and natural-response frequencies of the gas inside the connected piping.

Seebold, J. G.
SMOOTH PIPING REDUCES NOISE - FACT OR FICTION?
Hydrocarbon Process, v 52 n 9, Sept 1973, p 189-191

Control valves and high-speed machines in chemical plants produce far more noise than piping system components. Here is a method for estimating fluid flow noise in piping. It is concluded that there is no need for process engineers to concern themselves too much with flow noise in most piping systems of practical engineering interest in process plants, and that special designs for increased smoothness are rarely warranted. Possible exceptions are extremely high mass flow systems such as emergency vents and anti-surge bypasses, where significant flow noise may remain after the control valve (the real culprit) has been handled. 6 refs.

Skiedrzynski, M.
HALLAS LOZYSK TOCZNYCH W POMPACH ZEBATYCH (NOISE OF ROLLING-CONTACT BEARINGS IN GEAR PUMPS)
Przwgl Mech, v 31 n 10, May 25, 1972, p 304-308

A method is proposed for reducing forces acting on the bearings in oil pumps having spur gears and the tooth contact ratio exceeding unity. The method consists in providing ducts in spacer plates and cutting tooth point on the teeth's surfaces of both the working gears. Diagrams show the reduction in the level of noise produced by the bearings and the whole pump following the application of the method described. In Polish.

Stryczek, S; Kollek, W.
WPLYW OBJECTOSCI MARTWEJ NA HALASLIWOSC PRACY OSIOWYCH POMP WIELOTLOCZKOWYCH (INFLUENCE OF DEAD VOLUME UPON THE NOISINESS OF AXIAL-FLOW MULTI-PLUNGER SWASH-PLATE PUMPS)
Przegl Mech, v 31 n 12, June 25, 1972, p 368-372

Relations are derived between the sound pressure of noise produced by an axial-flow multi-plunger pump and the magnitude of a dead volume of displacement space. Influence of the rotation angle of rotor upon the pressure in the pump displacement space is discussed. The dependence is determined of pressures of compression and pre-expansion upon timing gear angles and upon the ratio of the dead volume to the theoretical volume displaced from the displacement space. 4 refs. In Polish.

Sullivan, J. W.
ENGINEERING CONTROL OF INDUSTRIAL NOISE
Soc of Mfg Engr, Mfg Mgt, Tech Paper MM 70-613

Control of noise in the industrial environment by engineering methods is preferred over other means for the conservation of hearing. Implementation of noise control begins with noise measurement and analysis to define the problem and to identify and quantify sources of noise and transmission paths. Superb opportunities are available for built-in noise control at conceptual or early design stages of both equipment and buildings; but more pressing are the problems related to noise after the fact. Guidelines are given for controlling noise with add-on techniques and devices, and case histories are presented.

Thomas, D. E. Jr.; James, R. Jr.; Sparks, C. R.
SOME PLANT NOISE PROBLEMS AND SOLUTIONS
Hydrocarbon Process, v 51 n 10, Oct 1972, p 149-152

Several case histories, applicable to chemical plant noise problems, are presented. The format is purposely very straightforward and is intended to demonstrate effectiveness rather than to detail the treatment design procedures used. The examples provide insight into the applicability of selected treatment approaches and provide quantitative data on reductions which might be expected. The case histories considered include - vacuum blower; pressure blowers; two-stage rotary screw compressor; hydrocarbon vapor pressure reducing valve; reciprocating compressors; and reciprocating compressor building.

Winnerling, H. A.
QUIETING OF PROCESS MACHINERY
Chem Engr Progress, v 69 n 6, June 1973, p 96-99

A machinery silencing system that treats only the noisy areas or parts of the machine is described for a plastics pelletizer. This machine was effectively quieted by absorptive panels and silencers installed directly on it. This type of silencing arrangement provides reasonable noise control for equipment having complex and multisource radiating patterns. The arrangement allows for direct product feed and removal as well as easy access and maintenance. Once a particular design is made, the system can be replicated at relatively low cost. With modification, this technique could be applied to other noisy machines.

Petroleum and Coal Products -

Adamson, M. G.
NOISE ONE OF MINING'S MOST INTRACTABLE ENVIRONMENTAL PROBLEMS
Mining Mag, v 127 n 2, Aug 1972, p 94-96

Paper discusses: recent developments in suppressing the noise in compressed-air, percussive rock drilling and air compressing; noise reduction to 90 dB or less by use of ear plugs and ear muffs, as well as the sound levels in general. Decibel rating and equivalent energy of common sounds are presented in tabulated form.

Arcuri, K.
CAUSES AND CURES OF STEAM PIPELINE NOISE
Oil and Gas J, Tulsa, Okla, v 70 n 48, Nov 27, 1972, p 66-68

A pipe transmits and directs any small disturbance within it, and it also picks up and carries noise emanating from surrounding equipment. Within the fluid, noise originates from pulsating flow, fluid-wall interactions, fluid mixing, and shock waves. Once sound is generated, the way it is transmitted through space affects actual sound pressure. In terms of impact on personnel, transmission of sound is often more significant than its generation. Methods of quieting steam pipeline noise include minor modification, retrofitting, sizing and designing pipe so that the velocity is low, using quiet valves and regulators, employing silencers and insulation, and avoiding internal projections.

Arcuri, K.
QUIET-STREAMLINE DESIGN TO COMPLY WITH OSHA RULES
Chem Engr, v 80 n 1, Jan 8, 1973, p 134, 136, 138

Walsh-Healy noise regulations can be met for steam pipelines through the application of noise-oriented design techniques and new pipeline components, such as quieter regulators and more gradual expanders. Causes of pipeline noise, the ways sound is measured, and the Walsh-Healy Act are discussed.

Beaumont, E. L.
REDUCTION OF COAL CAR UNLOADING NOISE
ASME Paper 72-PEM-18, for Meet, Oct 15-18, 1972

Describes the cause of and a unique approach toward the solution of a noise problem involving the unloading of coal at a fossil fuel electric generating station. The noise source is a coal car shaker, consisting of eccentric weights mounted on a shaft belted to an electric motor which impact the side rails of the coal car and induce vibration, causing coal to flow through the bottom hopper of the car. This repetitive impacting causes noise which is deafening at the site of unloading and which is intolerable to a residential area near the power plant. A geographical description of the relative locations of the shaker, power plant, residential area and other neighboring structures is presented, along with a brief history of early attempts to solve the problem and the subsequent conclusion of sufficient preparatory redesign of the shaker. 5 refs.

Cannon, R. M.
NOISE REDUCTION FOR EQUIPMENT OPERATIONS UNDERGROUND
Mining Congr, J, v 58 n 3, Mar 1972, p 36-41

Paper describes the steps undertaken since 1965 by the Columbia Cement Co. in its limestone mining and processing operations toward achievement of title goal. It began with testing of new employees' hearing and location of high noise areas. By the time the noise standards made law in 1969, Columbia had analyzed its noise problems and started implementing noise controls by: protective measures, wherever needed; and specifying to the manufacturers the supply of jumbo drills, loaders, trucks, etc. equipped with enclosed cabs, sound-insulated with foam-lead multiple layer material.

Dryden, S. L.; Judd, S. H.
THICK "QUIET" FROM INITIAL DESIGN TO PLANT OPERATION
Oil Gas J, v 71 n 8, Feb 19, 1973, p 102-104, 106-107

Building quiet into a refinery begins with early design. Providing an example is a crude unit which met its goals in plant, off plot, and in the nearby community without undue "Overkill"

Duck, B. W.
NOISE NUISANCE CONTROL BY OIL REFINERIES
Noise 2000, Assoc Intl Contre le Bruit, Intl Congresses, 5th & 6th (London, May 1968 and Groningen, Netherlands, May 1970)

In 1963 oil companies operating in Western Europe established an international study group at the Hague to investigate the oil industry's environmental pollution problems. The progress of a section on noise control toward stated objects is briefly reviewed. These objectives include collation of experience on neighborhood noise problems; information on legislation, standards, and codes; noise levels of particular types of equipment information on noise suppression measures; agreement on a standard method of assessing refinery noise levels; and development of a standard method of specifying noise levels for new equipment.

Hersh, A. S.: Kessler, R. A.; Seebold, J. G.
LOUD, FLOW-INDUCED HOWL ELIMINATED
Oil Gas J, v 71 n 44, Oct 29, 1973, p 107

Source of stack noise at the El Segundo refinery of the Standard Oil Co. of California was not known but revanping of internal geometry of system eliminated the howl.

Holvenstot, C. E.
DESIGNING SAFETY INTO UNDERGROUND MINING EQUIPMENT - NOISE ABATEMENT
Mining Congr, J, v 59 n 9, Sept 1973, p 39-43

Paper reviews the relationship between decibel levels and various common sounds and considers the extreme range in sound power level that the ear is capable of discerning. Experience in quieting machine machinery of the Ingersoll-Rand Co, dating to World War II is related and guidelines for reduction of the mining machinery noise are presented.

Hopper, B. L.; Seebold, J. G.
SOUND GENERATION IN FANS FOR REFINERY AIR COOLERS
ASME Paper 72-WA/FE-42, for Meet, Nov 26-30, 1972

Mechanisms which cause broadband noise generation in low-speed axial flow fans are discussed. The predominant source of noise is dipole, arising from fluctuating blade forces. Vortex shedding at the trailing edge of fan blades appears to be the primary source of this boradband noise. In addition, the static pressure rise across the blade, along with airfoil design influence the overall sound power level. Noise data measured from actual refinery air cooler fan installations is presented. Sharland's analysis is used as a basis of estimating overall broadband sound generation. Equations for predicting broadband noise levels are compared with numerous field measurements. 7 refs.

Kemp, D. A.; Meyer, J. J.
NOISE ABATEMENT TECHNIQUES FOR GAS TRANSMISSTION FACILITIES
Soc of Petro Engr of AIME, SPE4009, 1972

Successful techniques developed by the Humble Industrial Gas System for combating extreme noise are discussed. One particular noise source is high pressure gas regulators where extreme turbulence is created in the regulator body and exit piping. To cope with this particular problem, acoustical lagging is the method most commonly used for remedial work. Cellulose fiber, the most promising insulation material, was sprayed directly onto noisy piping sections. A 1.5 in. thick application reduced noise levels by 20 dBA. The basic concept was improved by developing a technique by which the cellulose could be sprayed to polyethylene to form sheets of insulation which could be field-installed. These sheets reduced noise levels and lowered total installation costs by 50 percent. For more acute noise levels, a layered combination of cellulose and high density septum (1.5 lb/ft^2 Pb) reduced noise levels by 30 dBA.

Lamonica, J. A.; Mundell, R. L.; Muldoon, T. L.
NOISE IN UNDERGROUND COAL MINES
U.S. Bureau of Mines, Rep Invest 7550, Aug 1971

The Bureau of Mines conducted an environmental noise survey to determine the noise levels to which underground coal mine employees are exposed, to evaluate noise survey techniques and equipment, and to compare noise exposures using two criteria, Walsh-Healy and Chaba. For determining allowable exposure that were under consideration for the Federal Coal Mine Health and Safety Act of 1969. The shift exposures of 20 percent of the miners studied were in excess of the safe standards established by both criteria. Ultimately the Chaba criteria were rejected, and the Walsh-Healy criteria were adopted.

Lamonica, J. A.
NOISE LEVELS IN CLEANING PLANTS
Amer Mining Congr, 1972 Coal Show, Papers, (held in Cleveland, Ohio, May 8-11, 1972)

In anticipation of noise regulations for coal mine surface facilities, the U.S. Bureau of Mines conducted a noise survey at three cleaning plants in an attempt to identify possible problem areas. Those occupations where the individual's exposure exceeded the limits of the proposed noise sources were identified. The manner in which sound energy is distributed over the audible range of frequencies was described.

Marchant, W. H.
HEATER AIR AND NOISE POLLUTION CONTROLLED IN REFINERIES
Oil Gas J, v 71 n 1, Jan 1, 1973, p 32-36

Stringent air-pollution regulations as well as fuel saving considerations compel refiners to take a hard look at the efficiency of fuel oil or gas fired heaters, which hitherto were operating at high excess of air. It is claimed by the manufacturers of heaters that an increas of thermal efficiency from 80 to 89 percent reduces the volume of total stack emissions by 10 percent. Other problems are caused by the operating noise of the heaters. Paper offers tips on solving combustion problems and how to quiet noise refinery components.

Mayer, W. H.
DETAIL STUDY OF REFINERY NOISE PROBLEMS

A hearing conservation program at a large petroleum and petrochemical plant that is based on past experience and the Occupational Safety and Health Act of 1970, is reviewed. Plant surveys, problem area definition, and medical and engineering control are discussed. A multidisciplinary approach is used in which medical, engineering, and operations departments share in the responsibilities for providing a suitable noise environment. The control of furnace and pipeline noise is examined in some detail.

Murphy, J. N.; Sacks, H. K.; Durkin, J.; Summers, C. R.
PROGRESS IN NOISE ABATEMENT
Mining Congr, J, v 58 n 9, Sept 1972, p 59-63

Rototype equipment to measure exposure in underground coal mines in compliance with PL 91-173 of the Coal Mine Health and Safety Act of 1969 has been developed. A possible approach to providing ear protection and still permitting the wearer to hear warning signals in the absence of noise is under evaluation with a discriminating ear muff, and progress has been made to reduce noise levels from a pneumatic drill. 8 refs.

O'Donnell, J. P.
TRUNKLINE EMPHASIZES ECOLOGY
Oil Gas J, v 69 n 22, May 31, 1971, p 74-77

Trunkline Gas Co. added almost 80,000 HP to its transmission system in 1970, divided approximately equally between reciprocating and turbine-compressor units. Use of new buildings to house eight of nine new compressor units relieved Trunkline Gas from having to conform to past practice and made some distinct departures possible. Noise attenuation was first of a number of measures taken to preserve environment.

Petersen, G. T.
NOISE CONTROL IN COAL PREPARATION PLANTS
Mining Congr, J. v 60 n 1, Jan 1974, p 30-36

Noise legislation is being introduced at all levels of government both in the United States and worldwide. Its purpose is to set safety standards and assure compliance for the protection of human health. This discussion, which deals with noise in coal preparation plants, recommends a systematic approach that management might use to control unwanted noise both in existing facilities and new installations. 3 refs.

Ray, S. K.
GULF CANADA SOLVES CRITICAL COMMUNITY NOISE PROBLEM
Oil Gas J, Tulsa, Oka, v 70 n 46, Nov 13, 1972, p 149-152, 157

A noise abatement program undertaken at a refinery in Port Moody, Canada, is described. A silencer was installed on a 50 lb steam vent, and cooling air ducts for an electric motor driving a recycle compressor were acoustically lined. A sound baffling wall covering the eastern end of the compressor was erected, and acoustically treated enclosures were built for charge pump and boiler forced-draft fans. A sound barrier was erected in the cooling tower inlet louvers and pump house, and a new flare tip was installed. Maximum noise level at the east boundary line decreased from 66 dBA to 55 dBA, and community noise level in the college park area was reduced from 61-63 dBA to 45-51 dBA.

Roberts, J. P.; Leventhall, H. G.
NOISE OF NATURAL GAS BURNERS
Appl Acoust, v 4 n 2, Apr 1971, p 103-113

The sources of noise in domestic, aerated, natural gas burners are located and discussed. Injector noise, resonance within the body of the burner, and flame roar are the components of the overall noise, each playing a dominant role in a given frequency range. Techniques for reducing the noise level are developed and their practical application described. 13 refs.

Seebold, J. G.
FLARE NOISE: CAUSES AND CURES
Hydrocarbon Process, v 51 n 10, Oct 1972, p 143-147

The author is concerned with noise caused by combustion and discusses the methods how to diminish it. Most flare noise problems can be cured today except intense combustion noise. Grade-level flares are 10 decibels quieter than elevated flares. Grade-level flares currently are in wider use in Europe than in the United States. The modern grade-level flare is refractory lined and equipped with many burners at the base. In some configurations, the stacks reach heights of 100 ft. Its capacity is limited, but the grade-level flare can be integrated. 17 refs.

Seebold, J. G.
NOISE TROUBLEMAKERS ARE IDENTIFIED IN REFINERY MECHANICAL EQUIPMENT
Oil Gas J, v 71 n 3, Jan 15, 1973, p 57-59

In controlling noise from mechanical equipment, centrifugal compressors offer the greatest problem. Broadband noise generated inside the machine currently must be treated externally.

Shore, D.
TOWARD QUIETER FLARING
Chem Engr Progress, v 69 n 10, Oct 1973, p 60-64

Noise from flares in petrochemical plants is discussed and an approach to assist noise and light reduction in flaring operations is described. Information is provided on factors in noise generation, the mechanism of the hydrocarbon flare flame, methods of steam injection, the Coanda effect, air entrainment, combustion frequencies, and community noise problems. Ground flare units are recommended to reduce light annoyance and community and in-plant noise problems.

Smith, D. B.
PREDICTING AND ABATING POTENTIAL NOISE PROBLEMS IN REFINERIES
Oil Gas J, v 70 n 8, Feb 21, 1972, p 58-61

Uncontrolled noise, considered a pollutant, can psychologically and physically damage personnel. It can provoke annoyance in nearby communities. A method is offered on how to predict and abate potential noise problems.

Spanaus, D. D.; Allan, K. N.
CONTROLLING NOISE IN COAL PREPARATION PLANTS
Allis-Chlmers Engr Rev, v 38 n 2, 1973, p 23-27

Methods of noise reduction to meet OSHA (Occupational Safety and Health Act) standards are described. Two basic methods for long term protection are recommended by OSHA, administrative and engineering. Personal protection is allowed as an intermediate step. Administrative solutions deal with management of a person's work schedule so that his cumulative noise exposure does not exceed allowable limits. Engineering solutions, on the other hand, deal with physical changes to the equipment or building environment. How noise reductions may be handled at these two levels is demonstrated, considering problem definition, alternate solutions, and implementation. Cost estimates are presented for noise control of a hypothetical plant. 3 refs.

Tree, D. R. (Ed)
Hydrocarbon Processing, v 52 n 10, Oct 1973, p 89-91

Plant noise can be estimated during the design stages and compared to appropriate noise legislation for the new plant site. Most noise ordnances differentiate between zoning categories -- the allowable noise decreases as the category changes toward residential. Some sources of noise can be identified by reviewing performance data provided by some manufacturers along with other performance information. Care must be used in assessing such information since it may be given either as sound power level or SPL. Environmental noise analyses must consider any outdoor attenuation, as well as decay with distance away from a sound source. The best method of noise control is thorugh process or product redesign.

Tyler, D. A.
NOISE CONTROL PROCESS EQUIPMENT
Amer Ind Hygience Conf, (San Francisco, Calif, May 14-19, 1972)

A variety of noise control techniques for common noises encountered in existing refineries and petrochemical plants is examined. The engineering concepts and designs, the materials used, the amount of noise reduction anticipated and/or achieved, and the approximate costs are discussed. A check list, used by one group for actions required by the Occupational Safety and Health Act of 1970 standard on occupational noise exposure, is demonstrated as an example. Also a method for the choice and priority of controlling noise sources is reviewed. Examples of "noise control data sheets" formulated for engineering departmental use are presented.

Werchan, R. E.; Bruce, R. D.
PROCESS PLANT NOISE CAN BE CONTROLLED
Chem Engr Progress, v 69 n 10, Oct 1973, p 51-55

Measurements of in-plant and community noise and identification of major noise sources are discussed. Information is provided on process equipment, noise levels, and noise sources in and near petrochemical plants, refineries, and ammonia plants. Process plant noise problems in the form of hearing damage risk, Occupational Safety and Health Act compliance, community annoyance, and local regulations are causing companies to consider engineering and administrative controls for in-plant problems. Engineering controls are necessary for community noise problems and should be considered in the design stage of new plants.

Wood, C. H.
INDUSTRIAL NOISE CONTROL
Can Mining J, v 91 n 10, Oct 1970, p 67-69

Noise, for the purpose of this discussion, consists of minute flucutations in the ambient air pressure. These pressure pulses travel through the air and register on our ear drums. This sensation is heard as noise. Various techniques and apparatuses used for reduction of industrial noise are briefly described. Presented at annual meeting of Mines Accident Prevention Assoc of Ontario, Toronto, May 20, 1970.

Working Group "Noise Control"
COMMUNITY RESPONSE TO REFINERY NOISE
Stitching Concawe, The Hague, Rep 5/72, June 1972

Questionaires were sent to European refineries requesting information on the number and types of noise complaints they received from the communities surrounding their plants. Data from these questionaires are presented with the object of using such data to achieve noise reduction. Because of the large number and wide range of variables, criteria for predicting community response specifically to refinery noise could not be derived. The lower of the International Standards Organization (ISO) basic criteria results in gross overestimation of the community response to noise in all circumstances and locations. Because of variations in response, the detailed breakdown of response grades in the ISO method is unrealistic and misleading. Both the higher of the ISO criteria and British Standards Institution criteria provide a useful means of assessing the potential incidence of complaint.

Yerges, L. F.
NOISE -- A COSTLY AND UNNECESSARY POLLUTANT
Amer Soc of Mech Engr, ASME Publ, 72-PRT-7, 1972

Noise sources in the petroleum industry are delineated; and force, energy and power concepts involved in the control of noise are considered. Available noise control procedures include noise reduction at the source, modification of noise transmission paths, and protection of exposed workers. Reductions of <20 dB are required in almost 90 percent of the cases studied; these reductions can be achieved quickly and economically.

Rubber and Plastic Products -

Anon
TODAY'S MATERIALS-HANDLING SYSTEMS: MORE AUTOMATION, LESS NOISE
Plast Technol, v 19 n 11, Oct 1973, p 60-61

In this survey of materials handling equipment that has been shown at the plastics exhibition '73, Chicago, emphasis is on automation for economic reasons and on noise control and other safety-related aspects by reason of the OSHA requirements.

Bell, L. H.; Raymond, A. J.
NOISE CONTROL ENGINEERING IN THE PLASTICS INDUSTRY
SPE, 29th Annu Tech Conf, Wash DC, Tech Paper v 17, May 10-13, 1971, p 403-406

Fundamentals of the physics of sound are discussed including instrumentation and measurement methods: part two deals with the identification and character of the major sources of molding room noise: fundamental methods of noise reduction are presented for each major source; finally, attention is focused on the equipment manufacturer and user. Here recommendations are presented for the organization and implementation of a system type engineering program for noise reduction in the plastics industry.

Murtland, W.
CONTROLLING EQUIPMENT NOISE
Rubber World, v 168 n 4, July 1973, p 65-66

The author reviews various sources of noise in industrial plants with particular attention to noise sources in rubber processing plants. Making a reference to the Occupational Safety and Health Act requirement, the article deals with methods of the noise abatement and indicates the necessity for standardization of silencing devices. 5 refs.

Peterson, R. I. Jr.
RESOLVING NOISE LEVELS IN PLASTIC PROCESSING PLANTS
SPT Natl Plast Expo Conf, Annu, Prepr Paper, Chicago, Ill, Nov 6-9, 1973, Pub by SPA, NY, 1973

This paper sets the stage and duscusses the sifting out of options in order to overcome a serious noise problem without changing design features that were contributing to the problem. The author reviews step-by-step these points in a plastic plant which may constitute the source of noise. Particular attention is given to the sound insulation of granulators, grinders, cutters, mixers, pelletizers, dicers, etc.

Shadley, J. R.; Bruce, R. D.
NOISE CONTROL IN THE RUBBER AND PLASTIC INDUSTRIES
IEEE Conf Rec, 23rd Annu Conf Elec Engr Probl in Rubber and Plast Int, Akron, Ohio, Apr 5-6, 1971, p 14-20

Stone, Clay and Glass Products -

Funke, G.
MINDERUNG VON ARBEITSLAERM IN ZEMENTWERKEN (NOISE ABATEMENT IN CEMENT PLANTS)
Zem-Kalk-Gips, v 26 n 9, Sept, 1973, p 441-447

The author describes the manner in which sound is generated at the main sources of noise such as crushers, mills, fans, compressors, chimneys and planetary coolers. Noise abatement measures applied are indicated. 7 refs. In German.

Funke, G.
SOUND PROPAGATION IN CEMENT PLANTS (SHALLAUSBREITUNG IN DER UMGEBUNG VON ZEMENTWERKEN)
Zem-Kalk-Gips, v 24 n 9, Sept 1971, p 425-430

Show in accordance with VDI 2571, the expected sound level at a given point in the vicinity of a cement plant to be set up can be estimated by the sound generated by the machines, the acoustic properties of the rooms where the equipment is to be installed, the sound insulation of the components, and the laws of sound propagation. This figure is determined for a cement grinding plant and the results compared with values measured near cement plants and with data listed in a diagram. In German.

Hosking, P. C.
IN-PLANT NOISE. UNWANTED BYPRODUCT OF CEMENT MANUFACTURER
Rock Prod, v 74 n 8, Aug 1971, p 55, 84-85

Each of the manufacturing steps in a cement plant creates noise. For years noise has been an undesirable byproduct of manufacturing operations. Now the Federal government has stepped in and defined how much noise each employee can tolerate during an 8 hr day. The legal limits presently are set by the Walsh-Healy Act. Paper gives noise creation data for various equipment involved in manufacturing of cement and discusses briefly techniques for allaying or abating that noise.

Johnson, D. A.
STUDY IN BALL-MILL NOISE CONTROL
IEEE Trans Ind Appl, v IA-9 n 6, Nov-Dec 1973, p 727-734

Ball mill noise can be controlled by the use of ear plugs or ear muffs worn by the individual. Soundproofing enclosures can also be used successfully for this purpose. Noise reduction can be accomplished with rubber mill liners on wet raw mills.

Primary Metals -

Asperger, G.; Lehmann, H.
NOISE IN FOUNDRIES (LAERMTECHNISCHE VERHAELTNISSE IN GIESSEREIEN)
Giessereitechnik, v 17 n 4, Apr 1971, p 120-125

A survey is given of the relative noise pollution by different parts of foundries. Molding and cleaning shops are discussed as the worst noise producers, and the sources are considered. In German.

Cambell, J. M.; Willis, R. R.
PROTECTION AGAINST NOISE
J Iron Steel Inst, (London), v 211 Part 5, May 1973, p 346-352

A number of noisy areas in iron- and steelmaking operations are discussed in the light of recent surveys. A detailed noise survey of an electric-arc steel plant is the basis for discussing reduction of exposure by rearrangement of work schedules and the use of preassembled launders. Extremely high noise levels have been measured during sight glass changing and stove valve operation in a blast-furnace area. In power stations and motor/generators houses sound proof cabins can be used effectively to reduce exposure of operatives. Existing plate and section mills represent a serious problem, in terms of both number and people exposed and the extent of exposure and for this reason emphasis must be placed on reducing noise at source. Finally, the solutions to three smaller problems of noise exposure are outlined. 3 refs.

Dreger, D. R.
NOISELESS COLD FORGING
Mach Des, v 46 n 1, Jan 10, 1974, p 107-109

Forging without impact or noise is now possible for small parts with orbital-forging. Bevel and face gears, stepped-diameter circular parts, and similar pieces to 3.25 in. diam can be cold-forged quietly and accurately. Developed at the Warsaw Polytechnical Institute, Warsaw, Poland (where it is called the "rock-die" method), orbital-forging machinery is now being produced, by license, in Japan, United States, and several European countries. Tool motion is as follows. The upper die is inclined at a slight angle from vertical and is orbited across the top surface of the workpiece. At the same time, the workpiece and the lower die, which is powered by a hydraulic ram, move upward against the orbiting upper die. Metal is gradually pushed either outward or downward (into the lower die cavities), depending on the die configuration. Although the principal detail in a part (gear teeth, for example) is formed in the lower die, simple contours such as indented or crowned areas can be formed simultaneously on the top surface of the piece by the upper die. The hydraulic ram continues to move up to a present physical stop, at which point the part is completely forged. The ram is then lowered, and a hydraulically powered rod moves up to eject the finished part.

Ecker, W.; Rotthaus, D.
ARBEITSKRAFT UND SCHALLBSTRAHLUNG VON PRESSEN UND HAEMMERN (ENERGY INPUT AND SOUND RADIATION ON PRESSES AND FORGING MACHINES)
Metall, v 27 n 6, June 1973, p 602-608

It is shown that by the use of models the relationship between energy input and sound radiation of metal working machines, effective methods for noise abatement may be derived. In German.

Eickelpasch, D
ERMITTLUNG DER SCHALLABSTRAHLUNG VON HUETTENWERKSANLAGEN (DETERMINATION OF SOUND RADIATION OF METALLURGICAL PLANTS)
Stahl Eisen, v 92 n 12, June 8, 1972, p 581-586

Results of noise measurements as a function of distance from a basic oxygen steelmaking furnace, a sintering plant, and a cement plant are reproduced and discussed. A measuring method used to isolate a specific noise from the total sound radiation of a plant is described. In German.

Goritzka, M.
PRINCIPLES OF NOISE ABATEMENT IN FOUNDRIES (PRINZIPIELLE WEGE DER LAERMBEKAEMPFUNG AN GIESSEREIANLAGEN)
Giessereitechnik, v 17 n 9, Sept 1971, p 306-308

On the premise that the machine is the primcipal source of noise, the theory and application of noise combating methods are discussed. The tumbler for cleaning castings is used as an example. In German.

Holmer, C. I.; Lagace, A.
EFFECT OF STRUCTURAL DAMPING ON THE SOUND RADIATED FROM IMPACTED STRUCTURES
Amer Ind Hygeine Assoc, J, v 33 n 1, Jan 1972, p 12-18

Theoretical and experimental evaluations of some damping treatments utilize to control noise from transfer of materials in a foundry are presented. A theoretical investigation is outlined which indicates that the change in peak radiated sound pressure level from an impact is proportional to the change in mass and stiffness of the impacted surface. The change in total sound power radiated is proportainal to the change in mass, stiffness and the loss factor of the impacted surface. The energy noise reduction has application in predicting the reduction of the time average reverberant field sound pressure level from a large number of impacts occurring throughout a period of time.

Latrobe, C. H.; Jorstad, J. L.; Hanna, G. T.; Robins, J.; Toriello, L. I.; Andrejack, J.; Hamilton, J.; Lagowski, B.; Maratray, F.; Cowen, P. S.; Ruf, H. W.
AMERICAN FOUNDRYMEN'S SOCIETY, TRANSACTIONS, PROCEEDINGS OF THE 75th ANNUAL MEETING, MILWAUKEE, WISCONSIN, MAY 3-7, 1971
Trans Amer Foundrymen's Soc, v 79, 1971, AFS, Des Plaines Ill

Following is the continuation of the list of titles and authors: Thermal Analysis as a Control of Chemical Analysis of Bronze by C. H. Latrobe; 390 - The Hypereutectic Aluminum-Silicon Alloy Used to Cast the Vega Engine Block by J. L. Jorstad; Effective Maintenance Management, by G. T. Hann; New Low-Odor, Nitrogen-Free, Furan Hot-Box Binder by J. Robins, L. I. Toriello and J. Andrejack; New Phenoloic-Urethane Nobake Binder by J. Robins, L. I. Toriello and J. Hamilton; Aging of MG-9-AL-ZN Alloys by B. Lagowski; Choice of Appropriate Compositions for Chromium-Molybdenum White Irons by F. Maratray; Cupola Emission Controls by P. S. Cowen; Noise Control at Grede Foundries by H. W. Ruf.

Lehrmann, H.
LAERM DURCH LUFTTECHNISCHE ANLAGEN IN GIESSEREIEN (NOISE GENERATED BY AIR CONDITIONING INSTALLATIONS IN FOUNDRIES)
Giessereitechnik, v 18 n 5, May 1972, p 149-152

Tabulated measurements show the considerable contribution of such installations as ventilators, exhausts, and dust removal equipment to the total noise level at different locations in foundries. Noise pollution in the neighborhood of foundries by such installations is also considered. In German.

Lehmann, H.; Krause, T.
MOEGLICHKEITEN ZUR LAERMMINDERUNG IM GIESSEREIBERTRIEB (POSSIBLE METHODS OF NOISE ABATEMENT IN FOUNDRIES)
Giessereitechnik, v 19 n 7, July 1973, p 219-223

Specific examples of successful noise reduction are described for the cleaning shops of light metal and iron foundries, a descaling machine, and a core shooting machine. In German.

Synnelius, S; Svensson, I.; Thyberg, B.
BULLER OCH BULLERBEKAMPNING I GJUTERIER (NOISE CONTROL IN FOUNDRIES)
Inst Verkstadstek Forsk, IVF Resultat 73629, Aut 1973

Investigations on how high noise levels in foundries may be reduced are made. The methods suggested inlclude damping of sound insulation around source and rearrangement of acoustics in foundries. The experiences gained from experiments are reported and evaluated. 18 refs. In Swedish with English summary.

Fabricated Metal Products -

Anon
ROLLENBAHNEN: WMWELTFREUNDLICH (ROLLER CONVEYERS -- NOISE NUISANCE ELIMINATION)
Foerdern Heben, v 22 n 16, Nov 1972, p 925-926

Legislation in the United States prohibiting machinery operation at noise levels above 85 phon has been responsible for the development of a noiseless conveyer with installed accumulating effect. The roller conveyor presented in the article differs from conventional continuous conveyrs in so far as the rollers are driven individually by a crosswise running round belt on a common drive shaft. The conveyor can also be driven in curves by only one shaft with the aid of universal joints and without using any further motors. In German.

Anon
WRAP-SPRING CLUTCH HUSHES RIVETING MACHINE
Power Transm Des, v 14 n 13, Dec 1972, p 25-27

This article shows how replacing a roller clutch with a wrap-spring clutch-brake quieted a double-head riveting machine.

Bruce, R. D.
A REVIEW OF NOISE AND VIBRATION CONTROL FOR IMPACT MACHINES
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

Noise control treatments for impact machines such as punch presses; jack drop, and chipping hammers; tumblers; and conveyers are described. Absorptive measures are effective in certain applications, and partial enclosing of machines yields as much as 10 dBA noise reduction. Total close-fitting enclosures achieve about 20 dBA noise reduction, and total enclosures with a lot of space achieve as much as 30 dBA noise reduction. Redesigned stripper plate actions reduce noise levels by approximately 8 dBA. Operating a punch in shear reduces noise levels by about 15 dBA.

Diehl, G. M.
SOUND POWER MEASUREMENTS ON LARGE MACHINERY INSTALLED INDOORS
Compressed Air, v 79 n 1, Jan 1974, p 8-12

Two-surface method described was developed for determining the sound power level of a machine when it is operating in an industrial environment. In this method, octave-band sound pressure levels are measured on the surfaces of two hypothetical parallelepipeds over the machine being tested. The second imaginary "box" is farther away from the machine than the first and therefore, its area is greater than that of the first.

Dreiman, N. I.; Lobinskii, B. M.; Klimov, Y.; Khesin, E. S.
REDUCING NOISE IN ROLLING AND TUBE PLANTS
Stal 8, Aug 1971, p 733-737; see also English translation in Steel USSR v 1 n 8, Aug 1971, p 649-652

The results are presented of an investigation into the levels of sound pressure and noise frequency spectrum in the operation of a semicontinuous 2800/1700 mill for hot rolling sheet, a continuous 1700 cold-rolling sheet mill, and also in some units for tube and wheel-rolling production. As a result of introducing a number of constructional developments, the noise level was significantly reduced.

Fearn, R. W.
SPREAD OF NOISE FROM BOILER ROOMS
Heat Vent Engr, J Air Cond, v 44 n 524, Mar 1971, p 437-442

Measurements showed that noise from large surfaces falls off differently than indicated by theory. The fall-off does not vary at different angular positions to a surface. Two week links were identified in the sound insulation of the boiler room exterior wall. The main one was a roller shutter door, the other an extensive area of glazing. Measurements were taken with a precision sound level meter fitted with an octave-band filter. It was calibrated before and after use with a pistonphone. Expressions are presented to obtain the sound pressure level outside when the noise is assumed to be a point source behind the surface and to estimate the noise ratings.

Hoffman, H.
POSSIBILITIES FOR NOISE REDUCTION ON MECHANICAL BLANKING PRESSES
Sheet Metal Ind, v 50 n 5, May 1973, p 259-264

Measured noise levels in sheet metal plants are between 85 and 110 dBA. Suggested noise reduction techniques described include: hydraulic impact dampers, vibration isolaters, throttle dampers on exhaust lines, staggered punch design and encased presses.

Huthwaite, B.
TRY NOISELESS RIVETING
Automation (Cleveland), v 19 n 10, Oct 1972, p 72-73

In the noiseless orbital headforming process a rotating tool or peen is held at a slight angle, generally six degrees, as it is brought to bear on the rivet to be upset. The peen moves in an orbital path as it contacts the fastener. There is minimal heat buildup between the tool and the part during the short time that the peen turns or "spins" around the radius of the rivet being headed. The force applied by the peen during the orbital movement can be controlled so that the fastener material is worked just slightly beyond its compressive yield strength, but short of its ultimate strength. A minute quantity of rivet material is displaced with each turn of the peen. The entire operation is noiseless since the material is displaced by constant pressure and not by a rapid series of impact blows.

Isert, W.; Meerkamm, H.
NOISE ABATEMENT OF CABLE MAKING MACHINERY BY MEANS OF DESIGN ANALYSIS
Wire World Intl, v 15 Double 1, Jan-Feb 1973, p 1-9

The tolerable noise level is defined in a number of ordinances and bylaws. This article discusses the practical value of these factory acts expecially in regard to cable stranding activities. The noise generated by cable making machines was recorded and evaluated over a space of several years. It was thus possible to isolate the major noise sources. Discussed are constructive measures toward a lowering of the noise level. The costs and investments involved are discussed by referring to the actual utilization of the measures on a machine.

Izumidate, A.; Ishida, S.; Itoh, S.
NOISE REDUCER FOR STEEL PIPE PRODUCTION, "MAGNESKID"
Hitachi Rev, v 22 n 4, 1973, p 161-167

The system described uses electromagnets to generate eddy currents in steel pipes rolling down skid rails. Braking action by the eddy current and electromagnetic force reduces the speed of the rolling steel pipes and the energy of impact, thus reducing the noise of impact between pipes being transferred. At the same time, scratch marks and deformations due to the collision and kick-out of pipes are prevented.

Langhe, R.
REDUCERING AV LJUDALSTRINGEN HOS BORTBLASNINGSUTRUSTNINGAR PA EXCENTERPRESSAR (NOISE ABATEMENT CAUSED BY AIR NOZZLES ON PUNCH PRESSES)
Inst Verkstadstek Forsk, IVF Resultat 74608, Feb 1974

The methods for noise reduction caused by escaping air from clutching drives, valves and pressurized air used for removal of blanked workpieces from dies are examined for optimum results. Guidelines for positioning of nozzles and piping arrangement are outlined. 8 refs. In Swedish with English abstr.

Matsui, K; Sakamoto, H.
UNDERSTANDING OF COMPLAINTS IN A NOISY WORKSHOP
Ergonomics, v 14 n 1, Jan 1971, p 95-100

The complaints of workers in a noisy workshop were taken as the basis of recognition and attitude to noise. However, all the complaints based on noise exposure could not be attributed to neurotic responses. The distinctive character of homostatic changes induced by noise exposure was attributable to the depression of the adreno-cortical function. The possibility was considered that the metabolism of the brain was disturbed by the noise exposure. It was concluded that the complaints of workers exposed to noise must be considered from the viewpoint that workers have a physical, mental and social existence. 7 refs.

Meerkamm, H.
LAERMBEKAEMPFUNG AN KABEL UND VERSEILMASCHINEN - BEDEUTUNG, AUFWAND UND ERFOLG (NOISE ABATEMENT OF CABLE AND STRAND-MAKING MACHINES - SIGNIFICANCE, COST AND SUCCESS)
Drahtwelt, v 59 n 1, Jan 1973, p 9-16

Based on noise measurement data recorded over several years, a review is presented of the noise pattern generated by cable and strand-making machinery, and the principal noise sources are discussed. Measures are proposed for noise abatement by improved machine designing. The resulting costs are examined by a practical example. 8 refs. In German.

Osman, A.E.M.; Sadek, M. M.; Knight, W. A.
NOISE AND VIBRATION ANALYSIS OF AN IMPACT FORMING MACHINE
J Engr Ind, Trans ASME, v 96, Ser B n 1, Feb 1974, p 233-240

Paper 73-DET-23.

Ostergaard, P. B.
INDUSTRIAL NOISE SOURCES AND CONTROL
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Papers, (Wash DC, Oct 4-6, 1972)

Sources of industrial noise are described, including impact noise from the operation of chippers, metal shears, and stamping and punch presses; compressed air; fluid systems; pumps; combustion; and extruding operations. Methods of identifying a noise source are discussed along with techniques for reduction of noise. A method for reducing noise from a large dryer in an industrial plant is analyzed.

Sahlin, S.
KARTLAGGNING AV LJUDS ALSTRING I KLIPPNINGSPRESSAR (INVESTIGATION OF NOISE IN PUNCH PRESSES)
Inst Verkstadstek Forsk, IVF Resultat 73619, June 1973

Methods to decrease or eliminate noise generated by air pressure release of punch presses are recommended based on results of investigations. Other noises generated by valves, clutches and other parts that strike each other are also studied and measures to abate the same are proposed. 13 refs. In Swedish with English abstr.

Schulz, G.
LAERMBEKAEMPFUNG FEI HUETTENANLAGEN (NOISE CONTROL IN FACTORY LAYOUT)
Glastech Ber, v 47 n 2, Feb 1974, p 17-20

Important mistakes over noise control are already made at the drawing board stage in design of a machine or the planning of a factory, because the important knowledge of technical aspects of noise control gained over the past 15 years is not used. By applying the appropriate rules and guidelines for permissible noise levels at the work place and its surroundings, all constructors should make their factories as noise free as possible by careful design and operation. To do this, each engineer must have the necessary basic knowledge. 14 refs. In German with English abstr.

Shinaishin, O. A.
ON PUNCH PRESS DIAGNOSTICS AND NOISE CONTROL
Inter-Noise 72. Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

Sound generation in punch presses was measured by wave form, frequency, and cross correlation analyses. Vibrations and noise can be reduced by slanting the die or punch, thus reducing the forces exciting the structure. Addition of mass or damping can also reduce noise. Increased damping is most effective at resonances and increased mass is useful at higher frequencies. The transmission path from the primary disturbed element of the machine to other radiating members can be broken and enclosures can be provided. Barriers can also be used to reduce noise radiated from the press area to the rest of the plant.

Shinaishin, O. A.
PUNCH PRESS NOISE, A PROGRAM FOR ANALYSIS AND REDUCTION
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Occupational Safety and Health Regulations are demanding the search for solutions to industrial noise in factories. Presses are among the more common and most noisy of the offending manufacturing machines. An approach to reducing the noise at the source which is the most desirable solution is discussed. Experimental and analytical work was done to isolate the separate sources of noise and their contribution to the overall noise. Presses were instrumented to monitor the different events generating excitation forces, and to measure the vibration levels of significant parts. Analysis of the data from vibration and sound made possible the correlation between the overall sound, the different events, and the vibration of key parts in the press. Steps are outlined to change the character of forces and vibrating parts to reduce the noise.

Yerges, L. F.
GUIDELINES FOR NOISE AND VIBRATION CONTROL
Sound and Vibr, v 7 n 8, Aug 1973, p 18-21

Almost all equipment and most processes in industry involve one or more noise and vibration producing mechanisms. The sources are coupled to many transmission paths and ultimately the noise reaches a receiver -- man or equipment -- which can tolerate only limited amounts of acoustic or vibratory energy. The engineer can predict noise output of most equipment from simple force, energy, and power relationships. Ordinary, time-tested noise and vibration control methods are outlined, and their effectiveness and cost are described.

Machinery Except Electrical -

Albijanic, R.; Pejak, P.
NEKI ASPEKTI ZVUCNOSTI NA PODRUCJU ALATNIH MASINA (SOME ASPECTS OF NOISE IN MACHINE TOOLS)
Inst Alatne Masine Alate Saopstenja, n 18, 1973, p 2423-2536

The generation of acoustic noise due to cutting processes and its effects onto the hearing threshold of operators causing damages in hearing are considered. The results of measurements of the acoustic sound level as a function of the dynamics and accuracy in parameters are presented. Experimental results in milling and grinding operations are given and evaluated. 19 regs. In Serbian with English abstr.

Anderson, J. S.
DESIGN TO REDUCE MACHINERY NOISE
Des Engr, (London), May 1972, p 59-62

Techniques for measuring noise are described and guidelines are given for reducing noise.

Angevine, O. L., Jr.
NEARFIELD MEASUREMENTS AND SOUND POWER
Acoust Soc of Amer, J, v 52 n 1, 1972, p 112-188

The measurement of noise generated by large machines in ordinary semi-reverberant rooms can only be done very close to the machine at distances which appear to be well within the nearfield of the machine considered as a single large noise source. But large machines are usually composed of a number of smaller incoherent noise sources. Arrays of such sources show the farfield beginning at distances comparable to the measuring points at 1 m from the machine used in the Cagi standard, or the prescribed path of recommendation 1680 of the International Organization for Standardization. Such measurements corrected to a uniform radius are used to determine total sound power. The results agree well with sound power calculated for the same machine from farfield measurements.

Attia, A. Y.
EFFECT OF CHANGE OF PITCH ON GEAR NOISE
J Sound Vibr, v 18 n 1, Sept 8, 1971, p 129-137

Results of an experimental investigation into the effect on gear noise of a change in the number of gear teeth are presented. Four pairs of gears, of 6 in. (15.24 cm) pitch diameter and of different diametral pitches, were tested in a power circulating [illegible] testing machine installed in an anechoic room. Results have shown that [illegible] increasing diametral pitch (other gear parameters and running conditions being the same) gear noise decreases considerably at first, tending to reach a minimum at higher pitches; the amount of noise reduction does not change with speed. A simple formula which gives values in close agreement with test results has been derived. The formula also shows a considerable change in gear noise with change in gear-rim thickness. 6 refs.

Baade, P. K.
CONTROL OF NOISE FROM MACHINERY
Noise and Vibr Control Engr Conf, Proc, (Lafayette Ind, July 14-16, 1971)

Various forms and standards used in the presentation of acoustical information and data for the selection and application of different types of machines are reviewed. Rating methods in five areas are discussed: sound power versus sound pressure; single number versus spectrum; frequency weighting; increments and accuracy; and certification.

Bradley, W. A.
HOW TO DESIGN NOISE OUT OF GEARS
Mach Des, v 45 n 30, Dec 13, 1973, p 149-153

After listing the most important design factors that influence the noise level of a set of gears, the author provides succinct suggestions as to what may be done in each area to minimize its contribution to quiet operation. The topics treated are: type of gearing; tooth profile; pitch; pressure angle; recess action; profile modification; overlap ratio; backlash; tooth loading; quality level; surface finish; gear runout and unbalance; gear ratio; resonance; lubricant viscosity; type of bearings; material; housing.

Bradley, W. A.
SOUND GEAR QUALITY
Mech Engr, v 94 n 10, Oct 1972, p 30-36

The major sources of noise in a gear unit are tooth meshing errors, natural resonances, bearing imperfections, windage, and sounds of auxiliary equipment such as lubrication systems. Any combination of and interaction between these noise sources can cause excessive amplitudes. Methods of correcting excessive noise based on either changing the source or insulating and confining the sound in a specifically enclosed area. The best method is to change the system either by reworking or maintaining different operating procedures. Mechanical impedance, power spectral density, and real-time spectrum analysis are but a few of the advanced methods for investigating mechanical noise and vibration. 31 refs.

Brosze, O.
DIE STRAHLUNGSIMPEDANZ DER ELLIPTISCHEN KOLBENMEMBRAN (RADIATION IMPEDANCE OF THE ELLIPTIC PISTON DIAPHRAGM)
Frequenz, v 26 n 3, Mar 1972, p 58-61

A method for derermining the real and the imaginary relative component of the radiation impedance of an elliptic piston diaphragm is presented. The relative components of the sound pressure amplitudes on the diaphragm surface are calculated. The components of the radiation impedance are then determined from the pressure exerted on the total diaphragm surface. They are calculated and graphically presented for the elliptical diaphragm with the major half axes KA = 0.5, 1.2, etc, to 10 (Minor half axes KB = 0.5 and KB = 0.2). The calculated values are compared with those of the rectangular and circular piston diaphragm having the same area. In German.

Constance, J. D.
CALCULATING THE MASKING EFFECTS OF NOISE
Chem Engr, NY, v 79 n 8, April 7, 1972, p 124-126

A method for calculating the masking effects of noise is presented. Examples of determining the noise level in an industrial environment are given using the results of a survey on typical noise levels of industrial machinery and other sources.

Ebbing, C.; Ostergaard, P. B.
NOISE LEVEL SPECIFICATIONS FOR MACHINERY AND EQUIPMENT
Sound and Vibr, Cleveland, v 7 n 1, Jan 1973, p 22-26

A recommended noise-level specification for the purchase of industrial machinery and equipment is presented. It is mainly intended to control in-plant noise in compliance with Occupational Safety and Health Act Regulations although it can also be applied to purchased components for original equipment product lines. The specification is useful to the buyer in setting meaningful noise limits and to the seller who has to meet his customer's requirements.

Edwards, A. T.
MACHINE NOISE AND ITS CONTROL
Ind Waste Mgt, Symp, (Sheridan Park, Ontario, Canada, Nov 3-4, 1971)

The general philosophy and design principles for controlling noise from machinery are discussed. Criteria applicable to industrial environments, commercial or office type operations, and for the community are described.

Engler, G.
DIE BESTIMMUNG VON MASCHINENGERAEUSCHEN MITTELS NOMOGRAMMEN (DETERMINATION OF MACHINERY NOISE BY MEANS OF NOMOGRAMS)
Technik, (Berlin), v 27 n 5, May 1972, p 319-323

Nomograms are established which allow the prediction of noise generated by machinery placed in free space assuming that the airborne noise of the most important partial noise sources and the noise damping effect of existing housing are known. The nomograms allow also the determination of the required sound level reduction for given limiting or optimum values. The difference between the prediction and the measured quantities does not exceed 3 dB. 9 refs. In German.

Francois, R.; De Montussaint, D.
THE USE OF A REFERENCE SOUND SOURCE IN STUDYING INDUSTRIAL NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

The development of an all-purpose sound source for measuring the acoustic characteristics of machines is described. The equipment can be used to establish noise levels of machines placed inside and outside buildings and to determine absorption characteristics of rooms and partitions. The acoustic power of machines in an environment perturbed by reflections can also be measured. The method is simple, saves time, and is very accurate.

Fukuma, H.; Furukawa, T.; Aida, T.
FUNDAMENTAL RESEARCH ON GEAR NOISE AND VIBRATION - 6. GENERATION MECHANISM OF RADIAL AND AXIAL VIBRATION OF SPUR GEARS.
Bull JSME, v 16 n 97, July 1973, p 1094-1107

The generation mechanism of the radial vibration and the axial one of spur gears is theoretically analyzed in consideration of not only the stiffness of shafts and bearings but also the mass of shafts in this report, where the concerned system of an infinite degree-of-freedom is converted to that of a finite one which has the same kinetic energy as the former, based on the assumption that the static characteristics of shafts and bearings can be applied to the dynamic condition. This analysis and the comparison of the calculated results based on it with the experimental ones indicate that the vibration model, represented by a system of coupled vibration, can give a comparatively good explanation of the characteristics of three-directional vibration obtained experimentally and that the conversion ratios from the circumferential vibration to the radial and the axial one depend on the combination of gears, shafts and bearings. 5 refs.

Goesele, K.; Beldie, I, P.
VERMINDERUNG DER BEARBEITUNGSGERAEUSCHE DURCH DAEMPFUNG (ABATEMENT OF MANUFACTURING NOISE BY DAMPING)
DFBO Mitt, v 24 n 4, Apr 1973, p 58-59

Description of experiments carried out to investigate the possibilities of alteration of noise generated in sheet metal processing workshops by hammering or grinding sheet metal parts. The application of rubber bands, plastics compositions, and loose sand in plastics bags was examined in these experiments. The achievable noise abatement was found to be in the range from 5 to 10 dB for relatively thin sheet metal. The possibility of noise alteration decreases with increasing sheet metal thickness. In German.

Hahold, S.
ZUR SYSTEMATIK DER GERAEUSCHMIDERUNG AN MASCHINEN UND GERAETEN (CLASSIFICATION OF MEASURES FOR NOISE ABATEMENT IN MACHINERY AND EQUIPMENT)
Ind-Anz, v 95 n 81A, Sept 29, 1973, p 1870-1873

The various noise sources resulting from the operation of machines, and the corresponding primary and secondary noise abatement measures are systematically and lucidly reviewed and tabulated. In German.

Hauck, L. T.
COMPUTER-AIDED VIBRATION ANALYSIS
ASME Paper 74-DE-1, for Meet, Apr 1-4, 1974

This paper begins with an introduction to narrowband real time analysis, with emphasis on machinery noise and vibtation analysis. The increase in processing speed provided by an RTA can prove to be a mixed blessing. Large amounts of data can be produced very quickly, and the increase in the bulk of data can result in a data management problem. This paper shows how a minicomputer can be used to manage an RTA. Emphasis is placed on a software approach that makes it possible for any engineer to use the system. By using a mixture of a conversational interpreter language and assembly language subroutines, an excellent balance can be struck between ease of use, flexibility, and system efficiency. A new method of producing Campbell diagrams is presented to demonstrate the system concept.

Holmer, C. I.
REDUCING MACHINE NOISE WITH PROPER DAMPING AND ACOUSTICAL TREATMENT
Natl Plant Engr and Maint Tech Conf, 23rd, Philadelphia, Pa, Jan 24-27, 1972, Sess Paper 29B

Noise may be a pollutant of the plant environment, for it can interfere with communication and produce permanent hearing damage. Essentially, noise control is achieved by modifying the path of sound transmission from the source to the receiver or modifying the source to reduce or redirect its sound power output.

Huebner, G.
ERRORS IN THE MEASUREMENT OF MACHINE NOISE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Even under free-field conditions, there are three types of errors in the measurement of machine noise: the nearfield error; the error caused by using a limited number of measuring points; and the error in measuring sound pressure at each point. The magnitude of these errors for measurements made in ordinary rooms following the procedures of recommendation 1680 of the International Organization for Standardization is discussed.

Huebner, G.
SOUND POWER DETERMINATION OF MACHINES IN SITU
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash DC, Oct 4-6, 1972)

The sound power level of machines can be determined by the method of enveloping surface. The environmentally influenced sound power level can be corrected by an equation, and the room influence error can usually be neglected for certain area ratios. Room influence error can be calculated by measuring a test source of known and constant power output or by using an estimate survey method.

Kemper, G.; Ottl, D.
PHYSICAL STUDIES OF VIBRATION EXCITATION AND SOUND EMISSION IN THE GRINDING OF THIN SHEET, WITH SPECIAL REFERENCE TO THE POSSIBILITIES OF COMBATING NOISE (PHYSIKALISCHE UNTERSUCHUNGEN DER SCHWINGUNGSERREGUNG UND SCHALLEMISSION BEIM SCHLEIFEN VON FEINBLECHEN UNTER BESONDERER BERUECKSICHTIGUNG DER MOEGLICHKEITEN ZUR LAERMBEKAEPFUNG)
DFBO Mitt, v 21 n 11, Nov 1970, p 209-216

Results of studies are reported which were aimed at noise reducing. A simple method to reduce the noise by some decibles was not found, however, some possibilities for noise combating are reported. In German.

Kubo, A.; Ando, T.; Sato, S.; Aida, T.; Hoshiro, T.
ON THE RUNNING NOISE OF TOOTHED BELT DRIVE-2
Bull JSME, v 14 n 75, Sept 1971, p 998-1007

The influence of the construction and the dimension of toothed belt and some running conditions on the noise of toothed belt drive are investigated and some running noise reduction methods and their effectiveness are shown. The effective methods to reduce the meshing impact sound and to keep the toothed belt drive silent are: to soften the bottom lands of toothed belt or tooth tip lands of wheel, to make belt width narrow, to cant the belt of tension side with an idle pulley, to make the wheel noncylindrical, especially as barreled-shape.

Kurowski, W.; Zmierczak, T.
WYZNACZANIE NADWYZEK DYNAMICZNYCH W PRZEKLADNIACH ZEBATYCH (DETERMINATION OF DYNAMIC EXCESSES IN GEAR TRANSMISSTIONS)
Przegl Mech, v 32 n 18, Sept 30, 1973, p 642-646

Paper presents a method for determining occurrences and magnitudes of dynamic excesses in gear transmitting by means of the spectrum analysis of acoustic waves that are emitted by the transmission. 2 refs. In Polish.

Lang, W. W.
MEASUREMENT OF NOISE FROM MACHINES
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Papers (Wash DC, Oct 4-6, 1972)

The purposes of a program for measuring machine noise are discussed. Two types of machine noise are commonly encountered: steady and unsteady noise. Sound pressure level (SPL) and sound power level are described, along with weighted and band SPL's. Measurement procedures available include survey, field, and laboratory methods. Basic standards and test codes are analyzed, and an example of a noise measurement program is given.

Lang, W. W.
NOISE MEASUREMENT STANDARDS FOR MACHINES IN SITU
Acoust Soc of Amer, J, v 52 n 1, 1972, p 122-188

Two classes of documents prescribe standards for noise measurements on machines and stationary equipment in the field. Fundamental methods of measurement are described in documents prepared by American National Standards Committee S1 for which the Acoustical Society of America serves as the secretariat and by Technical Committee 43 of the International Organization for Standards. Test codes applicable to specific types of equipment are prepared in the United States by engineering societies and trade associations. These two classes of documents should be mutually supportive and interdependent, but such is not always the case. The requirements of existing standards on noise measurements in situ are summarized, the shortcomings of these documents are described, and the needs for new standards are reviewed. An estimate is given of the degree to which current standardization activities are satisfying these needs.

Lura, L. E.; Walker, R. B.
BEARING NOISE REDUCTION
SAE Paper 720733, for Meet, Sept 11-14, 1972,

Bearing noise may result from variable processing techniques and/or improper application practices. Examples are cited, and methods for measuring bearing sound level are described. Such abuses at the point of application as brinelling, electric arcing, magnetization and improper axial preloading are considered.

Meteer, C. L.
WORKABLE SOLUTIONS TO COMMON MACHINERY NOISE PROBLEMS
Pollut Engr, v 6 n 1, Jan 1974, p 43-45

Problems associated with operational accessibility, material flow, finished product removal, maintenance and other operational concerns to be preserved to ensure acceptable levels of productivity are discussed. Case histories presented show successful solutions that can be considered in solving similar equipment noise problems.

Pitts, L. S.
BEVEL AND HYPOID GEAR NOISE REDUCTION
SAE Prepr 720734, for Meet, Sept 11-14, 1972

Gear noise originates at the meshing action of the tooth surface due to the localization or mismatch of these tooth surfaces introduced for practical operating considerations. Because of the logarithmic nature of the decibel scale, in order to effect a 6 dB reduction in gear noise the output, the vibration or angular displacement error must be reduced to one-half of its original value. Efforts to reduce gear noise at its source is limited by the practical consideration created by mounting displacement. Ninety-eight percent of the noise created by bevel and hypoid gear meshes is fundamental, second, or third harmonic mesh components. 5 refs.

Reisch, K.
NOISE LEVEL AT REWINDER REDUCED WITH NYLON GEARS
Pulp and Paper, San Francisco, v 46 n 4, April 1972, p 90-92

The installation of alternating nylon gears with metal gears on the drive train of a high-speed rewinder in a paper mill resulting in a measruable reduction of the noise level. The method of noise level measurement and results of analysis used in the experiments are discussed and a general summary of noise reduction procedures is given.

Robe, T. R.; Rogers, J. C.
ON THE CONTINUOUSLY TAPERED ARBOR SPRING SLIP CLUTCH
J Engr Ind, Trans ASME, v 94 Ser B n 3, Aug 1972, p 883-889

Paper 71-WA/DE-11.

Route, W. D.
GEAR DESIGN FOR NOISE REDUCTION.
Des Pract: Passenger Car Autom Transm, SAW Transm Workshop Meet,
2nd ed publ by SAE, NY, (Adv in Eng, v 5) 1973, p 58-70.

There are several rather widely accepted design rules believed to aid in the control of gear noise. Total contact ratio should be greater than 2.5 with at least involute contact ratio not less than 1.2. The finest pitch and the lowest pressure angle should be selected consistent with strength requirements. Tooth action close to the base circle should be avoided and a long angle of recess and short approach are essential.

Satter, M. A.
DESIGN AND ANALYSIS OF AN OIL CUSHION.
J Mech Engr Sci, v 15 n 1, Feb 1973, p 48-52

The dynamic characteristics of an oil cushion, which was originally designed to eliminate impactive excitation to a mechanical lever and thereby achieve noise reduction have been studied both theoretically and experimentally. The system motion is represented by a second order non-linear differential equation which can be reduced to a first order linear differential equation by changing the variables. An approximate but simple solution to the non-linear equation has also been presented. Theoretical and experimental results have good agreement. 8 refs.

Satter, M. A.; Downs, B.; Wray, G. R.
REDUCTION OF IMPACT NOISE AT THE DESIGN STAGE: A SPECIFIC CASE STUDY.
Inst Mech Engr (London) Proc, v 186, paper 26, 1972, p 391-399

A case study is made on the tack driving assembly of a boot and shoe lasting machine, and relates to the impact noise occurring during part of the machine cycle. Much of the noise is radiated due to vibrations at several frequencies of the tack driver lifting lever, which is excited by the direct application of impacts during the tackdriving process. An experimental approach was used in lieu of a theoretical treatment. Small design changes, based on the knowledge gained from the experimental investigations, have resulted in noise reductions from 10 to 14 dB being achieved.

Stevens, J. H.
MINIATURE BEARINGS REDUCE SPEED AND NOISE
Power Transm Des v 13 n 5, May 1971, p 51-54

Ball bearing speed reducers are discussed.

Trengrouse, G. H.; Bannister, F. K.
NOISE DUE TO AIR EJECTION FROM CLASH SURFACES OR IMPACT FORMING MACHINES
ASME Paper n 73-det-62 for Meet Sep 9-12, 1973

The noise forging machine is usually attributed to a combination of: the sudden deceleration of the exposed surfaces of the moving parts on impact, and the subsequent vibration of the machine tool structure. The present paper concerns a third possible source, namely the high-speed ejection of air from the edges of the rapidly diminishing gap between the billet and die immediately prior to impact. It comprises an attempt, using the method of characteristics, to analyze theoretically the wave action in the space between the two surfaces and in the surrounding atmosphere. The simple case considered is that where the impacting surfaces are plane and parallel, exploratory experiments, using a drop test rig are also described. 4 refs.

Utilities

Arcuri, K.
MINIMIZING NOISE IN STEAM PIPING SYSTEMS.
Power Engr (Barrington, Ill), v 76 n 11, Nov 1972, p 42-45

New hardware, such as quieter regulators and more gradual expander, plus improved design techniques concerning flow velocity, bends, radii, silencers and insulation are described. An analysis is also presented of noise radiating characteristics and methods for measuring sound levels.

Cleveland, A.
NOISE AND OTHER ENVIRONMENTAL CONSIDERATIONS IN THE DESIGN AND PLANNING OF GAS COMPRESSOR STATIONS IN THE U. K.
ASME Paper 72-GT-110 for Meet March 26-30, 1972

Compares some representative alternative designs for individual enclosures with the design of an equivalent building and concludes that for a small numbers of units, the individual enclosure is the economic solution. Other aspects of noise, including venting of gas are discussed and future design trends indicated. In the consideration of future designs, ease of maintenanace and security are fundamental considerations, together with the need to ensure that noise emitted will not pollute the environment.

Dibelius, N. R.; Marx, W. F.
ENVIRONMENTAL LEGISLATION: HOW IT AFFECTS FOSSIL-FUEL-FIRED-POWER-GENERATING EQUIPMENT.
Mechn Engr, v 95 n 3, March 1973, p 76-80

The principal emphasis of this review is on air pollution. The authors provide an up-to-date summary of Federal environment legislation and regulations which have been enacted pertaining to gas-, steam-, and combined gas- and steam-turbine power-generating equipment.

Ellis, R. M.
COOLING TOWER NOISE GENERATION AND RADIATION
J Sound Vibr, v 14 n 2, Jan 22 1971, p 171-182

An investigation has been carried out into the generation of noise by large natural-draught cooling towers, and the mechanism of noise radiation from them, based on measurements made at four large power stations. An expression relating the A-weighted acoustic power of a tower to its physical characteristics has been derived. This, together with the arc sources at high frequencies, has enabled a complete prediction method to be proposed. This method was used to estimate the noise from three future cooling towers and gave excellent agreement with the levels which were subsequenctly measured. 1 ref.

Freeman, C. W.
INDUSTRIAL GAS TURBINE NOISE CONTROL
J Inst Fuel, v 46 n 383, Feb 1973, p 87-91

The basic noise sources of the industrial gas turbine are those of the aero engine, with the exception that there is no generation of jet noise. A fairly standard industrial installation design has evolved, using the dissipative splitter type of silencer to reduce the intake and exhaust airborne noise and enclosures for the reduction of carcase noise. In the future higher gas flow velocities will have to be tolerated. To avoid breakdown of the silencer acoustic infill under these conditions, a suitable infill proteciton will need to be developed. 4 refs.

Freeman, M. L.
LOW-NOISE VALVES FOR STEAM PLANTS.
Power Engr (Barrington, Ill), v 76 n 12, Dec 1972, p 42-45

Noise control is only one advantage of special valves for steam plants. Reduced erosion and vibration are also achieved, with valves originally used in natural gas service. Data are given on high pressure drop-angle, double-seated and low-noise anticavitation types.

Hiramatsu, T. M.; Iwao, T.
GAS TURBINE AND ACOUSTICAL CONSIDERATION
Hitachi Rev, v 23 n 2, 1974, p 50-55

Basic problems in the control of noise from package type gas turbines are discussed. Some features of acoustical control techniques that are applied to these machines are described.

Katra, I. S.; King, D. B.
NOISE-CONTROL DESIGN USING SCALE MODEL TESTS
ASME Paper 71-WA/PWR-7 FPR Meet Nov 28 - Dec 2 1971

Case history of noise - control project at a large turbomachinery test facility where the study of scale models was successfully used to circumvent these difficulties to a large extent. The paper also includes performance data on a number of piping noise - control material combinations, which should be useful in a broad range of problems involving radiation from pipes of similar structures, and describes an outdoor sound level monitor useful in detecting community noise problems. 12 refs.

Kondrat'ev, V. T.; Mamin, V. M.; Pykhov, L. S.
SOUND PROPAGATION IN VARIABLE-SECTION DUCTS CARRYING A COMPRESSIBLE GAS FLOW.
Sov Phys, Acoust v 19 n 6, May - June 1974, p 542-545

The propagation of sound in narrow tubes of variable cross section is analyzed with allowance for motion of the gas medium. The dependence of the acoustic impedance on the geometry of uniform tube sections and the gas-dynamical parameters of the medium in them is obtained for sound wave-lengths much greater than the length of each transition segment. An analytical equation is derived for the acoustic impedance in the case of a local change of cross section in an infinite tube and small Mach numbers; the resulting equation is analyzed. 7 refs.

Loesch, W.
FUNDAMENTAL RELATIONS BETWEEN THE ORIGIN OF NOISE CAUSED BY FURNACES AND THE TECHNICAL POSSIBILITIES OF NOISE REDUCTION, (GRUNDLEGENDE ZUSAMMENHAENGE DER GERAEUSCHNTSTEHUNG AN OFENANALAGEN UND TECHNISCHE MOEGLICHKEITEN ZUR LAERMMINDERUNG)
Stahl Eisen, v 91 n 9, April 29 1971, p 488-494

It is shown that the noise of furnaces, for process as well as space heating (offices), is due mainly to lf resonant vibrations of the gas column in the furnace and stack; methods for precalculating the critical frequency, avoiding it by design, or providing sound insulation are discussed; noise caused by burners and blowers is also considered; examples of successful noise abatement are given. In German.

Mani, R.
NOISE DUE TO INTERACTION OF INLET TURBULENCE WITH ISOLATED STATORS AND ROTORS
J Sound Vibr, v 17 n 2, July 22 1971, p 251-260

The problem of sound generation due to free stream turbulence incident on a rotor or stator row is studied analytically. A linearized analysis is carried out with the blade rows being modeled as a cascade of flat plates. Only the dipole effect is considered. Expressions are obtained for the intensity spectrum of noise upstream and downstream.

Moravec, Z.
CAUSES OF SIREN HOWL IN THE AXIAL STAGE OF A TURBOMACHINE, (URACHEN DES SIRENENGEHEULS IN DER AXIALEN STUFE EINER SCHAUFFLEMACHINE)
Rev Roum Sci Tech, Ser Mec Appl, v 16 n 3, 1971, p 611-619

The most important cause of the siren noise in turbo-machines is the presence of nonuniform pressure fields behind the cascade generated by the suction behind the blades. This noise is radiated in frequencies which are expressed by a whole multiple of the blade number and rmp number of the rotor systems. Some relationships between the geometry of the axial stage and the siren noise are investigated. 7 refs.

O'Donnell, J. P.
GAS COUNCIL ADOPTS TURBOCOMPRESSORS
Oil Gas J, v 69 n 39, Sep 27, 1971, p 95-96, 101-102

Third part of four part series on British Gas Council, describes the first compressor station installed at Alrewas, England, that in time, will be followed by 10 to 12 more with a total, installed power between 200,000 and 300,000 hp. They will be equipped with gas turbine driven turbocompressors. Preservation of the environment, with particular emphasis on noise attenuation, is an important element in design.

Ol'Shtein, L. E.; Trekhtenbroit, M. A.
OBTEKANIE RESHETKI PLASTIN NERAVNOMERNYM VIKHREVYM POTOKOM SZHIMAEMOGO GAZA. (FLOW OF A VORTICAL STREAM OF COMPRESSIBLE GAS AROUND A PLATE GRID)
Izv Akad Nauk, Mekh Zhidk Gaza, n 1, Jan-Feb 1972, p 92-100

Solution is given to the problem of a plane-parallel transmission flow of an ideal gas with a small nonuniformity of nonpotential character around a cascade in motion. It is shown that monchromatic pressure waves are generated, the frequencies of which are multiples of the repetition rate of the cascade blade. Analytical expressions are obtained for the wave intensity and for the total radiated acoustic power and its spectral composition. Applicable to the study of noise generated by the interaction of wake of consecutive blade cascades. 6 refs. In Russian.

Salter, C. M.; Hoover, R. M.; Bradley, W. E.
COMMUNITY NOISE SURVEY AND CRITERIA FOR A POWER STATION--A CASE STUDY
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Power companies are expecting to double their electrical generating facilities every 10 years, and in order to build new facilities these companies need the approval of local and state agencies. A case study is presented of a power company that had a 560-Mw facility completed in the late 1960's and petitioned the state for permission to build an additional 560-Mw facility. The acoustical criterion proposed by engineers for unit 2 was nondegradation of the present ambient sound level; the combined plant must not exceed the present ambient level of 45-50 dBA at the nearest neighbors in all directions. To achieve this criterion, noise sources will be quieted both in the existing unit and in the future unit. Results are presented of an initial community ambient noise survey around the existing plant made to establish the present conditions. The individual noise sources determined at the time to be distinct contributors to the plant noise in the community are described as 400-Mw autotransformer; air intake louvers to forced draft fans; the main 560-Mw transformer; and boiler feed pump equipment. Sound pressure level data of these sources, both close-in and in the community, are presented as examples of some typical community noise problems associated with power plants. Also the requirements for noise control as related to the planned addition are discussed.

Schwarzenbach, A.
NOISE IN STEAM POWER STATIONS
Brown Bov Rev, v 59 n 1, Jan 1972, p 30-35

A general review of the effects of noise and methods of measurement is followed by a description of measurements taken in the machine houses of two power stations, from which measures for reducing the noise level are derived.

Sullivan, B. M.
ENGINE INTAKE SYSTEM NOISE CONTROL
Diesel and Gas Turbine Progress, v 39 n 1, Jan 1973, p 14-15

The 5 major noise pollution sources on a truck include fan noise intake and exhaust noise, engine mechanical noise, other mechanical noises, and tire noise. Noise reduction laws are discussed, and intake noise is examined. Ways of reducing intake noise levels include turbocharging and intake silencers. The key to good intake system noise control is the properly designed air cleaner, which requires a proper match of the duct sizes to the cleaner size, proper inlet design and location, and proper design and location of interior components, such as the filter elements, baffles, and finned or vaned centrifugal separators.

Tage, R. B.
NOISE CONTROL OF GAS TURBINE POWER PLANTS
Sound and Vibr, v 7 n 6, June 1973, p 23-27

Considerations in the silencing of gas turbine power plants are discussed. Allowable noise levels are determined from experience or legal requirements. Major sources of noise are enumerated and methods of quieting each are described. A line of silencing equipment allows each installation to be tailored to its site to ensure neighborhood acceptance and meet legal obligations.

Thomassfn, H. G.
BERUECKSICHTIGUNG DER SCHALLEMISSION BET DER PLANUNG UND BEIM BAU VON KRAFTWERKEN, (CONSIDERATION OF NOISE EMISSION DURING PLANNING AND CONSTRUCTION OF POWER PLANTS).
VGB Kraftswerstech, v 54 n 1, Jan 1974, p 43-46

Using as examples a large steam power plant and a peak-shaving gas turbine power plant. Paper describes the measures which have been taken to reduce noise emission. It has been ascertained by extensive measurements that, in the case of the steam power plant the acoustic waves were propagated over a large area; whereas, the noise in the gas turbine plant was generated primarily at the intake end and at the exhaust gas duct. In German.

Thompson, M.P.
NOISE CONTROL TECHNIQUES FOR BOTH NEW AND EXISTING STATIONARY ENGINES AND COMPRESSORS.
ASME Paper, n 74-DGP-6 for Meet April 28-May 2 1974, p 11

Describes the noise control program of a stationary engine and compressor manufacturer. The primary objective of this program was to develop techniques and products which would be applicable to both new and existing units. Since the program started from scratch, the paper also describes the equipment and test facility needed to evaluate the techniques and products which were developed. The program investigated the three basic noise control techniques of vibration reduction, sound absorption and sound path blockage. A first generation noise control product was developed which reduced a particular engine's noise level from 99 dBA to 90 dBA. Some techniques which hold promise for a second generation noise control program are included.

Trakhtenbroit, M. A.
PROPAGATION OF WAVES OF SMALL PERTURBATIONS THROUGH A PLATE ROW IN TRANSONIC GAS FLOW
Izw Akad Nauk, Mekh Zhidk Gasa, n 4, July-Aug 1971, p 85-91

In connection with studies on the noise and vibrations excited in turbomachinery blades, solution is given to the problem of interaction in a transonic gas stream under zero angle of attack. The results obtained are applied to the approximate solution of the problem concerning plane sound wave transmission through a row of plates having a finite chord. Results are compared with those obtained by other authors. 5 refs. In Russian.

Van Rooy, A. H.
NATURAL GAS COMPRESSOR STATIONS IN THE NETHERLANDS - 1.2.
Pipeline Gas, J, v 200 n 2, 3 Feb 1973, p 28-29, March 4 between p 47 and 54

Two-part paper describes the pipelines systems, operated in the Netherlands by the N. B. Nederlandse Gasunie, that consists of main feeder lines - with a maximum working pressure of 66.2 bar (960 psi) and pipeline diameters of 36.2 bar (570 psi). The design and operating philosophy of the six compressor stations and their importance to the gas transmission systems are described. Detailed design consideration in so far as stress analysis and noise abatement are discussed.

Van Steenbrugge, B.
COMPRESSOR STATION "OMMEN" SILENCING MEASURES
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congresses, 5th & 6th (London, May 1968 and Groningen, Neth., May 1970)

The Netherland's gas compressor station ommen, has operated for one-half year with four compressor units of 15,000 hp each, driven by gas turbines. The station is situated in a rural environment which made it necessary to fix the permissible noise levels at the rather low noise rating value of 30 outside the nearby houses. Particulars about the composition and dimensions of the silencing equipment are given. Graphs with measuring results from some noise sources are shown.

Waxham, T. J.
PROCEDURE FROM CONDUCTING AND EVALUATING NOISE SURVEYS AT GAS TURBINE INSTALLATIONS.
ASME Paper, n 73-GT-37 for Meet April 8-12 1973

Once a gas turbine station is put into operation, a noise survey is recommended to determine the sound levels created by the station as a whole and to pinpoint the individual levels of each major piece of equipment. The results of the survey can be used to evaluate the silencing equipment and to point out those places where additional sound treatment would be most beneficial. This paper presents a discussion of the three phases of a typical survey: planning, conducting, and evaluating.

Yamaguchi, N.
AXIAL FLOW TYPE FORCED-DRAFT FANS FOR UTILITY BOILERS.
ASME Paper, n 74-GT-130 for Meet March 30-April 4 1974

Single-stage axial fans with variable-pitch moving blades have recently been employed as forced-draft fans in most large boilers. Because of their excellent aerodynamic performance over a wide range of operations. They provide greater plant efficiency than any other type of F. D. S.'s. Their flow and pressure rise have now reached a height of 27,000 M**3/min., and 1,500 MMAQ, respectively. This paper surveys the aerodynamic features and problems of these F. D. fans, the history and the present state of their development in Japan, and finally, it explains briefly their structure and mechanism. 4 refs.

Mixed Category -

Aaronson, S. F.; Bair, J.; Luken, V. D.
LIFT TRUCK NOISE ANALYSIS AND REDUCTION STUDY.
ASME Paper, n 72-WA/MH-1 for Meet Nov 26-30 1972

A noise abatement program which reduced cab noise on a medium capactiy lift truck by 17 dB is presented. The procedures used to reduce noise and measure average cycle noise are documented, the evaluation criteria discussed, and a technique for noise reduction cost-effectiveness studies on product changes is presented. Special emphasis is placed on both the sound pressure level and the duration of the exposure. This consideration is pertinent due to recent legislative activity.

Anderson, C. G., Jr.
DESIGN PRINCIPLES FOR LOW-NOISE PNEUMATIC EQUIPMENT
ASME Paper, n 73-DE-46 for Meet April 9-12 1973

The requirement for low-noise portable pneumatic equipment has come to the forefront since the passage of the Williams-Steiger Act and OSHA requirements for a reduced noise level in industrial environments. This paper is directed toward the design principles for reducing the nosie level of portable pneumatic equipment and cites some case histories of the application of these principles. 3 refs.

Baron, R. A.
AMERICAN INDUSTRY MUST END THE TYRANNY OF NOISE
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congresses, 5th & 6th. (London, May 1968 and Groningen, Neth., May 1970)

Industry must take the initiative to design for quiet without waiting for legislation and proof of large market. The motivation is preservation of the human environment. Some voluntary moves have already been made in the U. S. Manufacturers have voluntarily made silenced giant portable air compressors, a quieter garbage truck, a silenced metal garbage can, a silent calculating machine. Legislation will now be needed to protect these progressive manufacturers from their noisier but cheaper competition, to protect the public from misleading advertising, and to improve design goals. But the Federal government is moving too slowly. Industry can choose to sit back and wait, or it can voluntarily expand displays of leadership mentioned above. To educate industry to its responsibility to man and his environment is a major goal of citizens for a quieter city. The ultimate noise abatement goal must be a partnership of government, citizen, and industry.

Becker, R. J.
TECHNIQUES FOR REDUCING HYDRAULIC SYSTEM NOISE.
Control Engr, v 20 n 12, Dec 1973, p 61-63

The author presents a practical account of how to go about reducing component noise in hydraulic system designs. Noise reductions achieved with variable displacement pumps are reported and evaluated.

Bell, L. H.; Mull, H. R.
PRACTICAL ASPECTS OF MACHINE NOISE MEASUREMENT AS INSTALLED
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Many industrial manufacturing and processing companies, at the urging of plant engineers and safety directors, are requiring maximum noise level guarantees for purchased machines. Since as installed measurements form the basis of acceptance and provide plant engineers the only information available to assess noise impact, many questions are being asked about the value and practical aspects of these measurements. Some practical aspects that must be considered include choice of instrumentation; treating unwanted reflecting surfaces and background noise; dealing with pure tones and nonsteady noise levels; and assessment of probable range of errors. The discussion also includes some practical applications of as installed measurements.

Blazier, W. E., Jr.
CHILLER NOISE: ITS IMPACT ON BUILDING DESIGN.
ASHRAE Trans, v 78 pt 1, 1972, Paper 2234, p 268-277

Recent data on the noise levels of currently available compressor equipment of the type and size generally encountered in central station, building air conditioning are presented. The purpose of the study was to obtain a statistical description of compressor noise based on measurements made in operating installations of manufactured equipment.

Bruce, W. C.; Rodman, C. W.
ENVIRONMENTAL NOISE: ASSESSMENT AND IMPACT
Inter-noise 72. Intl Conf on Noise Control Engr Proc, (Wash, D. C., Oct 4-6, 1972)

Procedures for conducting base line surveys of industrial noise are described, including methods of selecting measurement locations, techniques for predicting plant noise potential and extent of acoustical treatment required to meet government restrictions, and ways of predicting the effect of plant noise on the environment. Environmental impact statements are discussed, and facility construction is considered.

Cashmore, D. H.
HOW TO ESTIMATE INDUCTION MOTOR NOISE LEVELS
Sound and Vibr, Cleveland, v 6 n 10, Oct 1972

The sound pressure and sound power levels of three-phased induction motors can be estimated from limits proposed by the National Electrical Manufacturers Association and the International Electrotechnical Commission. Applicable testing standards are reviewed and typical motor design guidelines for low-noise performance are discussed. Dripproof (DRPR) and totally enclosed fan cooled (TEFC) motors were compared under no-load conditions in a controlled environment at rated voltage and frequency in accordance with specifications of the Institute of Electric and Electronics Engineers. The noise produced by DRPR motors is substantially less than that produced by TEFC motors.

Chen, Y. N.
FLOW-INDUCED VIBRATION AND NOISE IN TUBE-BANK HEAT EXCHANGERS DUE TO VON KARMAN STREETS.
Pressure Vessels and Piping: Design and Anal - A Decade of Prog, v 2, Available from ASME, NY, NY, 1972, p 1373-1385

Treats the problem of vibration and noise in tube-bank heat exchangers. The frequency of vortex shedding has been investigated by many authors, and shedding has been investigated by many authors, and their results have varied considerably. The author, in previous works, correlated these different data into a curve group, and now proceeds to further analyse the problem. Results of experiments performed in a small wind tunnel are given, accompanied by typical graphs. Based on the findings, the author concludes with some design proposals for suppressing vibrations. 41 refs.

Cheremisinoff, P. N.
PLANT NOISE SURVEY TECHNIQUES
Pollut Engr, v 4 n 3, May-June 1972,p 39-41

The objective evaluation of industrial noise levels prior to attenuation is discussed. Of four quantities of importance--sound pressure level, distance from the source at which a change in sound field occurs, sound intensity and sound energy density--sound pressure level is the most readily measurable. The use of the microphone for measurement is discussed, and the advantages and limitations of major microphone types are listed. Manufacturers of industrial sound measuring instrumentation are also given.

Cho Kang, R.; Murata, S.
STUDIES ON THE NOISE OF AXIAL FLOW FAN.
Bull JSME, v 16 n 94, April 1973, p 742-751

Axial spacing and the tilting angle in the spanwise direction between guide vane and rotor blades are dealt with as parameters concerning their effects on noise reduction. Measuring the pressure fluctuation on the blade surface of the guide vane is also included. 4 refs.

Connor, W. K.
NOISE CONTROL
Chem Engr, v 80 n 14, June 18, 1973, p 165-169

Over the next five years, full development of legislative and enforcement programs of in-plant noise controls can be expected along with tightening of existing noise limits. Potential noise problems, methods of measurement, and basic terminology are discussed. Control techniques such as mufflers, silencers, enclosures, and mechanical isolation and vibration damping are suggested as means of achieveing noise control without special engineering design.

Contrance, J. D.
PUT NOISE CRITERIA TO WORK FOR YOUR PLANT.
Power, v 117 n 4, April 1973, p 25-27

Guidelines are given for establishing maximum noise levels in specific zones of modern plants.

Constance, J. D.
RATE THE NOISE OF UNDUCTED HVAC EQUIPMENT BY THIS SIMPLE STEP-BY-STEP PROCEDURE.
Power, v 118 n 2, Feb 1974, p 70-71

A method for relating industrial plant noise level requirements to the sound power levels reported by manufacturers of heating, ventilating, and air conditioning units, combines the effects of room size and configuration, sound-absorption characteristics and distance of occupant from sound source.

Copley, L. G.
ENGINEERING APPROACHES TO PLANT NOISE CONTROL.
ASME Paper, n 73-DET-88 for Meet, Sep 9-12 1973

This tutorial paper outlines various approaches to controlling plant noise by means of physical characteristics of buildings and machinery. Building-related topics covered include the effects of walls, barriers, and plant layout in isolating noise and the use and limitations of sound-absorptive acoustical material in reducing noise levels. Machinery-related topics include noise specifications for new equipment and engineering modifications to existing machinery. 24 refs.

Cremer, L.
SECOND ANNUAL FAIREY LECTURE. THE TREATMENT OF FANS AS BLACK BOXES.
J Sound Vibr, v 16 n 1, May 8 1971, p 1-15

The "black box" theory of communications engineers is extended to treat some problems of aerodynamically generated noise, such as the noise of ducted fans. Presentation of the necessary extensions of the theory, and its physical interpretation, is followed by a description of experimental work showing that axial and centrifugal fans act like momentum sources. Methods for measuring the relevant fan parameters are described, and results of measurements are given, demonstrating the ability of the method to give good predictions of ducted fan noise, for both model scale and full-size fans.

Curry, R. W.; Weber, J. A.
NOISE AND PERFORMANCE OF AN AXIAL-FLOW FAN WITH VARYING SHROUD AND CORE SPACING.
Trans Amer Soc Agr Engr, Gen Fd, v 15 n 5, Sep-Oct 1972, p 822-826

An investigation of 24 late-model farm tractors revealed that the spacing between the leading edge of the fan and the radiator (fan spacing) varied from 7/16 to 5-3/4 in. Tests of an engine cooling fan at two speeds and two air-flow rates showed that the effects of fan spacing and projection on performance and sound-power level were related to the point of operation of the fan on its static pressure-flow rate curve. 9 refs.

Debiase, J. S.
CRITERIA AND DESIGN SPECIFICATIONS FOR PLANT NOISE CONTROL.
S/V, Sound Vibr, v 6 n 9, Sep 1972, p 26-30

Hearing conservation and community intrusion noise criteria for achieving proper noise control for a new industrial plant are presented. The need for both sound level and frequency spectrum information is pointed out, and the use of octave band noise criteria is recommended. As a supplement to specific criteria, information to assist the contractor in meeting a plant's noise control requirement is suggested.

Finkelstein, W.
PRELIMINARY COMPUTATIONS OF FAN NOISE.
Build Serv Engr, v 41, March 1974, p 268-275

The values derived apply to near optimum operating for either the pressure or suction sides of a fan and show that in order to determine the room sound levels in a ventilated area, it is necessary to know the fan sound power output frequency spectrum to enable computation of the required sound attenuation characteristics. 8 refs.

Fry, A. T.
NEW CYLINDRICAL ATTENUATORS
Heat Ven Engr, J, Air Cond, v 44 n 525, April 1971, p 497-504

Attenautors specifically designed for direct connection to the inlet and outlet of axial flow fans. Two attenuator types evolved for each fan size are illustrated. They both have a length approximately equal to one-and-half diameters and have acoustic lining as their outer walls, within the sheet metal casing. One design contains an extra central pod to achieve larger quantities of attenuation, although at the expense of aerodynamic pressure loss.

Gibson, D. C.
NOISE REDUCTION IN COMPRESSED AIR DRIVEN FANS
Australas Inst Min Metal Proc, n 246, June 1973, p 13-20

The development of a noise attenuated compressed air driven fan is described. The fan, which employs the jet reaction principle, possesses blade extension pieces which penetrate into an acoustically treated annular chamber. The dominant noise source, namely the air jets, is thereby partially suppressed. In addition, the increased moment arm of the jets leads to an improved propulsion effect which contributes to the improved aerodynamic performance of the unit. A typical measure of the improvement of this type of auxiliary mine ventilation unit is a 4 percent increase in efficiency and a 10 dBA drop in sound level for a fan duty of 0.5 KPA and 1600 litre/s. This degree of attenuation corresponds to at least having the loudness level, a subjective noise measure. 5 refs.

Goodfriend, L. S.; Kessler, F. M.
INDUSTRIAL NOISE-IMPACT ON THE COMMUNITY
J of Environ Sci, v 15 n 5, Sep-Oct 1972, p 18-22

Industrial noise in the community which is above the ambient may be accepted or allowed by the community so long as it meets certain limitations. Industrial neighbors may not object to plant noise even at fairly high levels if it is continuous, does not interfere with speech communications, does not include pure tones or impact, does not contain fear produced elements. Some industrial plant equipment which generates noises that might be community problems can often be controlled by conventional mufflers and enclosures. Many state-of-the-art methods are available and may be applied when public need or local governmental action requires them. Industrial plant noise might be a more serious community problem without the following factors: transportation noise dominates large regions of industrial areas, and an interactive process between local government and industry leads to noise control measures by industry.

Goodfriend, L. S.
INDUSTRIAL NOISE IN THE COMMUNITY--CURRENT VIEWS
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 291-392

Noise from industrial plant has continued to be a problem for both plant management and their neighbors. Recent acceptance of the A-weighted sound level to rate noise, results of several federal studies, and an evaluation of the normalized community noise equivalent level (NCNEL) have changed the community-industry situation little, but prepare the way to develop workable methods for rating noise situations in a manner similar to the earlier composite noise rating, but without measurement of the spectrum. Furthermore, the interrelationship of a community and its industrial neighbors appears to play a major part in the acceptance of the noise levels surrounding the plant. There is no universal method of rating community noise that will satisfy any given percentage of neighbors in a community without first determining attitudinal factors that can be applied in the noise evaluation as weighing factors. Further research is currently under way.

Gordon, C. G.
INDUSTRIAL NOISE CONTROL: A CASE STUDY
Noise and Vibr Control for Ind Conf, P, (Bath, Eng, April 10-12, 1972)

A case study is presented which involves the development of noise design constraints for the installation of a new plant in a foundry in the midlands of England. The various stages of development are described. Arc-furnace noise prediction, extrapolation to new plant design, community criteria, noise control design, and alternative site.

Graham, J. B.
HOW TO ESTIMATE FAN NOISE
V Sound Vibr, v 6 n 5, May 1972, p 24-27

New method of fan noise estimation is provided in this article. Specific sound power levels of all common types of fans are tabulated. A simple equation involving only fan delivery volume and pressure is used to correct these specific ratings to actual sound power levels generated. Recommendations for fan noise specifications to be used in purchasing are also provided.

Guhlmann, B.
ZUM GERAEUSCHVERHALTEN VON KEALTEMITTELVERDICHTERN. (NOISE CHARACTERISTICS OF REFRIGERANT COMPRESSORS)
Luft Kaeltetech, v 8 n 3, June 1972, p 119-124

An equation is set up through which the predetermination and estimation of the A-rated sound power is rendered possible when service conditions, refrigerant, geometrical volumetric delivery and material of compressor body are known. The equation is nomographically represented for simplification. In German.

Hart, F. D.; Reiter, W. F.; Royster, L. H.
A COMMUNITY NOISE PROBLEM/RESOLUTION
Inter-noise 72. Intl Conf on Noise Control Engr Proc, (Wash, D. C., Oct 4-6 1972)

Noise levels inside and outside an industrial plant in Pickens, South Carolina, were measured. Normal conversation was not possible inside dwellings located near the plant, although noise levels inside the dwellings probably would not result in permanent hearing loss. Housing residents considered noise levels in the range from 50-55 dBA acceptable, but levels from 65-70 dBA were considered noisy or excessibley noisy. An acceptabl rating for a noise level of 76 dBA was found. A court order requiring the plant to provide noise abatement measures is reviewed.

Healiss, K.
IS THE NOISE FROM YOUR FACTORY SAFE?
Environ Health, v 81 n 4, April 1973, p 69-72

Sources and definitions of noises, and methods of noise measurement are discussed. Industrial noise is divided into steady wide band noise, steady narrow band noise, single impact noise, and repeat impact noise. The effects of noise, especially hearing damage, are reviewed, including acoustic trauma, temporary threshold shift, and permanent threshold shift. Major sources of factory noise, their effects on the community, and methods of noise control are outlined. Serious consequences of continued exposure to high intensity noise necessitate a rigid program of noise measurement and control.

Illinois Institute for Environmental Quality, Task Force on Noise
CONTROL OF NOISE FROM STATIONARY SOURCES
Ill Inst for Environ Quality. IIEQ Document TF-2, Jan 1972, p 76

Regulations which are structured with specific noise limits expressed in decibels, for a variety of setting are proposed for Illinois. The numbers and the limits proposed for near term realization are based upon technological realities. Standards for the future are based upon a realistic faith in what technology can reasonably be expected to create by way of improvements. The limits which are proposed were also developed from known community reaction of noise and a review of control law in other jurisdictions both within the U.S. and abroad. A comprehensive review will be made within a reasonable time after a set of limits is promulgated by the Illinois Pollution Control Board.

Il'Yashuk, Y. M.; Simin, A. I.
MEASURING AND STANDARDIZING NOISE CHARACTERISTICS.
Meas Tech, v 15 n 6, June 1972, p 911-913

The problem of reducing the noise from machines, industrial equipment, treansportation facilities, and even domestic appliances is becoming more urgent each year all over the world. The noise characteristics of machines are considered to be a distinctive criterion for the quality of their construction and assembly. Efforts being made in the Soviet Union as embodied in the All-Union State Standard (AUSS) 11870-66 entitled Machines. Noise characteristics and methods of determining them, and other standards related thereto, with some indication of present deficiencies therein.

Johnson, C. N.; Hamilton, J. F.
CAVITY RESONANCE IN FRACTIONAL HORSEPOWER REFRIGERANT COMPRESSORS
ASME Paper 71, Vibr-88 for Meet, Sept 8-10 1971, p 7

The paper describes an investigation concerned with sources of noise in a fractional horsepower, rotary vane, refrigerant compressor typically used in domestic refrigerators, freezers, and air conditioners. Measurements of the compressor sound field, using fixed bandwidth narrowband spectrum analysis equipment, revealed a variable amplitude harmonic of the pumping frequency. The variability correlated with shell-cavity gas to resonance in the lowest transverse mode. Cavity resonance in small hermetic refrigerant compressor is unlikely to create substantial change in the amplitude of the fundamental pumping frequency. Upper and lower bounds on cavity resonant frequency in the first transverse mode are reported as a function of shell diameter.

Kipp, E. R.
DIE SCHALLEISTUNG VON SCHRANKKLIMAGERAETEN. (NOISE LEVEL OF AIR CONDITIONING CABINETS)
Klim Kaelte Ing, v 2 n 2, Feb 1972, p 55-58

The noise data of the components of ventilating and air conditioning installations should be based on noise levels. The determination requires frequently high experimental expenditure, e. g., application of a reverberation chamber. However, there are also other methods available which enable us to determine the sound noise level of air conditioning equipment with less expenditure. In the paper discussed such a method is explained, using an airconditioning cabinet as a test example. In German.

Kollek, W.; Stryczek, S. T.
EINFLUSS DES UMSTEUERVORGANGES AUF DEN SCHALLDRUCKPEGEL DER AXIALKOLBENPUMPEN. (INFLUENCE OF REVERSE MOTION OF PLUNGERS ON THE SOUND PRESSURE LEVEL OF SWASH-PLATE PUMPS)
Mashinenbautechnik, v 21 n 10, Oct 1972, p 467-473

The main cause hydraulic noise in swash-plate pumps is the reversing of the plungers motion. The relations between the reversing process and the generated noise are investigated in a specially constructed pump and test stand. The results obtained indicate the possibility of attaining a substantial decrease in the sound pressure level by a suitable matching of the reversing process with the working pressure of the pump. 3 refs.

Krishnappa, G.; Jones, L. R.
FAR FIELD RADIATION OF ROTOR-STATOR INTERACTION TONES FROM AN ANNULAR DUCT
Natl Res Counc Can. Aeronaut Rep, n LR-568, April 1973

An expression is derived to calculate the directivity of the far field sound pressure levels radiated from an annular duct based on Tyler and Sofrin's approach for a circular duct. Both radial and circumferential variations in the acoustic pressure field inside the duct are considered in the derivation. A computer program to calculate the generation, propagation and far field radiation of tones from a single stage ducted fan is described. 4 refs.

Lancaster, A.
MECHANICAL EQUIPMENT AND APPLIANCES
Noise in the Environ, Causes, Effects, Controls, Conf, Papers. (Toronto, Ont., Canada, April 28-29, 1971)

Legislation is stressed as an effective technique for controlling industrial noise, and industry's resistance to technological solutions due to high costs is cited. Noise control regulations in Europe and the U. S. are reported.

Lang, J.
STOERUNG DER NACHBARSCHAFT DURCH BETRIEBSLAERM
Noise 2000. Assoc Internationale Contre Le Bruit. Intl Congresses, 5th & 6th. (London, May 1968 and Groningen, Neth. May 1970)

Research which examines methods of reducing and avoiding noise disturbance from industrial establishments is presented. A basis is provided by the cases of disturbance from factory noise to adjacent residential dwellings with which the State Research Institute for Thermal and Sonic Technology (Austria) dealt in the last 15 years. Three separate groups of industry can be distinguished with reference to noise production and methods of reducing the external emission of noise. Large plants that occupy considerable areas of land and where at least a part of the noise production is out-of-doors; fairly large enterprises operating in their own selfcontained industrial premises; and smaller plants that do not require an entire industrial premise and are therefore usually housed in the basement, ground floor, yard or annex of dwelling houses. The laws of extending and checking airborne and structure-borne sound are studied with practical examples and on a model.

Laux, H.
ZUR GERAEUSCHABSTRAHLUNG VON ZENTRALGERAETEN IN DEN MASCHINENRAUM. (NOISE EMISSION FROM APPARATUS INTO THE PLANT ROOM OF A CENTRALIZED AIR CONDITIONING INSTALLATION)
Klim Kaflte Ing, v 2 n 2, Feb 1974, p 59-62

The emission of noise from fans into the plant room of a centralized air conditioning installation with and without connections is measured and the effect of the various connecting pieces and the different means for damping and absorbing of noise of the sound insulation within the equipment investigated. In German.

Meador, C. L.; Allan, J. J.
EXHAUST VENT SILENCER DESIGN
J of Engr for Ind, NY, v 94 n 4, Nov 1972, p 1007-1019

Noise control problems exist where high pressure, high temperature gases are vented to the atmosphere. An example is used to illustrate an approach to the design of an acoustically treated expansion chamber for a typical noise problem caused by superheated steam vented to the atmosphere. An analysis is developed to aid in the design of the acoustically treated expansion chamber type muffler for broadband frequency application. The algorithm as well as the supporting theory are sufficiently general so as to be applicable to a number of high velocity gas-generated noise conditions. All frequencies showed transmission losses greater than 50 dB as required, in an experimental estimation. An appendix of terminology definitions is included.

Moore, C. J.
IN-DUCT INVESTIGATION OF SUBSONIC FAN "ROTOR ALONE" NOISE
J Acoust Soc Amer, v 51 n 5, May 1972, p 1471-1482

Circumferential, radial and axial microphone traverses were made in the duct of a 1-m diameter 4-bladed subsonic ventilation fan with no stators. Steady components of the rotor tones were measured and phase related to the shaft rotation. Results show that the acoustic field close to the rotor is dominated by its steady force field; at any multiple of rotational frequency the basic mode is present, having a number of lobes equal to the rotational frequency harmonic order. At greater axial distances the basic mode decays, leaving only modes of low circumferential order at the intake.

Nelson, F. C.
UNDERSTANDING GOVERNMENT REGULATION OF IN-PLANT NOISE.
ASME Paper, n 73-DET-37 for Meet Sep 9-12 1973

Paper describes the various considerations which went into the formulation of the noise regulation promulgated in the Walsh-Healy and Occupational Safety and Health Acts. It reviews the influence of noise levels, age and length of exposure on hearing damage discusses several of the proposed hearing damage-risk criteria. It discusses the OSHA noise regulations in some detail. Finally, the paper assesses present trends and suggests the ways in which in-plant noise criteria are likely to evolve. 8 refs.

Ostergaard, P. B.
SOUND IN BUILDINGS
Bldg Syst Des, v 68 n 6, June 1971, p 25-30

The author presents some practical pointers in control of noise in buildings. Mechanical noise sources, noise from kitchens, control of fan noise, pump impeller selection, and methods of isolation of vibration are discussed. Tabulated data for a simplified calculation of the requirements for sound attenuation for a complete fan system are presented.

Rink, C. N.
NOISE CONTROL IN AIR HANDLING SYSTEMS
Bldg Syst Des, v 68 n 5, May 1971, p 40-54

Modern silencers and a lining near the diffusers that result in a sound controlled system at a minimum cost are reviewed: How to select silencers.

Royster, L. H.; Creel, W. C.; Thomas, W. G.; Scott, C. E. III
SURVEY OF THE NOISE ENVIRONMENTS OF 300 SMALL INDUSTRIES IN NORTH CAROLINA
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 291-392

A total of 300 industries were surveyed with respect to their respective noise environments. These industries generally employed less than 100 employees. The surveys were conducted by the North Carolina Department of Labor Staff. Pertinent information concerning number of employees exposed, percent of employees exposed in different company size ranges, etc., was also obtained during the survey. These results are presented.

Schirmer, W.
LAERMSCHUTZ AM ARBEITSPLATZ ALS AUFGABE DES INDUSTRIEPROJEKTANTEN. (NOISE PROTECTION IN WORKING ENVIRONMENT AS PROBLEM OF THE INDUSTRIAL PLANNER)
Technik (Berlin), v 27 n 12, Dec 1972, p 781-784

The sound propagation in production workshops in investigated and formulas as well as measured results are presented for sound pressure level in rooms with various length/height ratios in presence of scattering objects (machines). Experimental studies are described which showed that a considerable noise level reduction is obtained by the use of screening walls or partitions covered with sound absorbing materials and by sound absorbing ceilings. 16 refs.

Schmidt, W.; Busch, G.
NOISE REDUCTION MEASURES IN LARGE INDUSTRIAL PLANTS, BASED ON ENGINEERING STUDIES. (INGENIEURMAESSIGE LAERMMINDERUNG BEI GROSSPROJEKTEN)
Stahl Eisen, v 91 n 9, April 29 1971, p 481-487

Steps taken during the construction of two large tube manufacturing plants, one a continuous tube rolling mill, the other producing longitudinally welded tubing, to reduce the noise levels, are described; some of the difficulties encountered occurred at the natural gas inlet, ventilation equipment, and a control stage; low-noise and cost-saving control of handling equipment by the use of pressure oil instead of compressed air is described in detail.

Schmitz, C. J.
ERFAHRUNGEN MIT LAERMABSORBIERENDEN SCHUTZKONSTRUKTIONEN. (EXPERIENCE WITH NOISE ABSORBING PROTECTIVE STRUCTURES).
Ind-Anz, v 95 n 19, March 2 1973, p 366-368

Several examples are presented which demonstrate practical possibilities of using special noise absorbing structures for increased noise abatement. Considered is noise generated by refrigeration plants, in ventilation shafts and in various cabins. Efficient partitions for factories, parking lots, etc., are also discussed.

Schultz, T. J.
PERSISTING QUESTIONS IN STEADY-STATE MEASUREMENTS OF NOISE POWER AND SOUND ABSORPTION
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Most steady-state methods for measuring the noise power of equipment and the sound absorption in a room depend on knowing the sound power output on the standard source. But the output of any sound source depends in principle on the radiation impedance presented to it, and this impedance is likely to change with the location of the source, as well as with changes in the amount and distribution of the absorptive material in the room. Moreover, no generally accepted method is available for measuring the sound-power output directly. For these reasons, the validity of the steady-state methods has been under suspicion for some time. Recent progress in making steady-state methods respectable is summarized. Some remaining problems are cited.

Scott, H. L.
PERFORMANCE OF SOUND ABSORBERS IN A RADIAL DIFFUSER CONFIGURATION
J Sound Vibr, v 19 n 4, Dec 22 1971, p 445-451

A classical wave theory approach is used to determine the radial attenaution in a simulated centrifugal fan or pump diffuser lined with sound absorbing material. For all circumferential modes the attenuation at large radii is virtually the same as that of the lowest mode in a rectangular duct lined on two opposite sides. However, at small radii, the attenuation rate increases markedly above the rectangular duct lowest mode value as the number of nodal diameters is increased. 5 refs.

Sculthrope, H. J.
INDUSTRIAL HYDRAULIC NOISE ABATEMENT
Sperry Rand Engr Rev, v 23 n 3, 1970, p 44-48

Noise suppression in the industrial hydraulic area as in traffic and aircraft areas, is a system problem whose solution requires a concerted effort on the part of component manufacturer, system supplier, and user. Careful attention to fine detail is necessary to correct it. The system approach to the problem provides substantial dividends particularly in marginal noise situations.

Sessler, S. M.
ACOUSTICAL AND MECHANICAL CONSIDERATIONS FOR THE EVALUATION OF CHILLER NOISE.
ASHRAE J, v 15 n 10, Oct 1973, p 39-46

Design parameters affecting the location of chillers within buildings and architectural noise control methods are discussed. Chiller noise data are analyzed and design methods presented for obtaining acceptable acoustical results, without overdesign. 8 refs.

Shah, K. S.; Vikram, R. K.
INDUSTRIAL & TRAFFIC NOISE
Environ Pollut and Its Control (Baroda, India, April 15-17, 1972)
Inst of Engr (India) Baroda Sub-Centre, (1972), p 24

The sources, effects, tolerance limits, levels, and methods of reducing industrial and traffic noise in India are examined. The need for regulation is stressed and the employment of regional planning to reduce the effects of noise is encouraged.

Senoo, Y.; Kodama, Y.
NOISE GENERATED BY LOW PRESSURE AXIAL FANS.
Bull JSME, v 16 n 102, Dec 1973, p 1900-1910

The generation and decay of these two kinds of noise are experimentally examined by changing various factors, such as the suction pipe geometry, the location and thickness of struts, and the combination of the number of impeller blades and the number of struts. The rate of decay of the rotating noise is predictable and in most cases the noise quickly decreases in proportion to the distance from the rotor, providing that the number of impeller blades and the number of struts are properly chosen. Therefore, the noise observed away from a low pressure axial flow fan is mostly the turbulent noise. 1 ref.

Taylor, R. M.
NOISE EMITTED BY FLUID POWER EQUIPMENT - ITS CAUSES AND CONTROL
Hydraul Pneum Power, v 19 n 220, April 1073, p 132-134

The main reasons for high nosie levels from hydraulic pump installations are discussed as a preliminary to a description of the most practical means of achieving a reduction in noise both when designing and installing plant. Methods of reduction of noise by design and y enclosure are described.

Teplitzky, A. M.
ECONOMICS OF NEW PLANT SITES BASED ON ACOUSTICAL CONSIDERATIONS
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 291-392

A graphical method is presented for estimating plant site area and setback requirements based upon maximum allowable property line nosie levels, plant noise levels, and type of building siding selected for the construction. In addition, a method is proposed for determining the economic break-even point for purchasing additional property as an acoustical buffer zone vs. the cost of improving the sound transmission loss of the building siding.

Willoughby, R. A.
NOISE MEASUREMENT TECHNIQUES FOR POWER TOOLS
ASME Paper, n 73-DE-11 for Meet April 9-12, 1973

Summarizes the history and background of the Cagi-Pneurop test code for the measurement of sound from pneumatic equipment and outlines its wide acceptance as a universal standard on the subject. The discussion also profiles the important aspects of the test code regarding equipment and test procedures. There is a brief discussion of environmental testing.

Wilson, P. J.
NOISE IN HYDRAULIC SYSTEMS.
Chart Mech Engr, v 20 n A, Sep 1973, p 89-92

Discusses the nature of noise and how it is measured; the principal causes of it in hydraulic systems and its suppression; and ends with a list of quietness guidelines. 5 refs.

Zinker, C.
AIR CONDITIONING IN TOWER BUILDING. INVESTMENTS AND DEVELOPMENT.
(LE CONDITIONNEMENT D'AIR DANS LES BATIMENSTOURS. LES INVESTISSEMENTS ET L'EXPLOITATION)
Chal Climats, v 36 n 421, Jan 1971, p 35-44

In French with English abstract.

Yoerger, R. R.; Mann, R. L.; Roley, D. R.
PERFORMANCE AND NOISE OF AXIAL-FLOW FANS WITH VARYING HUB DIAMETERS AND DOWNSTREAM CONSTRUCTIONS.
Trans Amer Soc Agric Engr (gen ed), v 16 n 5, Sep-Oct 1973, p 834-839

The study reported pertains to the performance and noise emission of an axial-flow fan, shroud, and radiator mockup as affected by varying the hub-diameter per outside-diameter ratio of a representative tractor engine cooling fan, and by the presence of cylindrical obstructions located downstream from the fan blades. 11 refs.

NOISE EFFECTS ON HEALTH

Criteria

Damage-Risk Criteria -

Barker, I. W.
NOISE CRITERIA: A REVIEW OF THE CRITERIA FOR THE ASSESSMENT OF NOISE IN CURRENT USE AND THEIR RELEVANCE TO THE PUBLIC HEALTH INSPECTOR
Environ Health, v 81 n 8, Aug 1973, p 153-160

The criteria for the assessment of noise and the application of those criteria are reviewed, with suggestions for use by public health inspectors when specifying standards. Information is provided on: A, B, C, and D weighting networks; phon and sones; perceived indexes and noise levels; noise rating and criterion curves; methods of noise assessment; and suggested standards for noise levels.

Boole, R. A.
SOME HEARING DAMAGE RISK CRITERIA AND THEIR MEASUREMENT
Inter-Noise, Intl Conf on Noise Control Engr, Proc (Washington, D.C. , Oct. 4-6, 1972)

Noise-induced hearing loss is a function of several factors: level or intensity of the noise; frequency content of the noise; length of exposure; and individual susceptibility to hearing damage. Most hearing damage risk criteria accept A-weighting as an adequate measure, but more elaborate criteria, based on octave and one-third octave band levels, have also been developed. These criteria include equal energy, equal temporary effect and damage risk contours. Research instruments for establishing and validating theories of damage risk and monitoring instruments used to determine complicance with a specific damage risk criterion are described.

Lipscomb, D. M.
INDICATORS OF ENVIRONMENTAL NOISE
Indicators of Environ Quality, Symp, Proc, Thomas, W.A. (ed) (Held in Philadelphia, Pa, Dec 26-31, 1971)

Human responsiveness to various sound stimuli is discussed, and stress is placed on potential indicative features of noise in the environment. Physical indicators, such as the phon, sone, and noy scales, and perceived noise level, are quite reliable, and the technology is sufficient for providing highly refined sound analysis. Physiological, auditory, and vestibular indicators, such as hearing threshold shifts, cochlear cell damage, and interruption of cochlear and vestibular blood supply, can also be used to define the mechanisms of noise damage. Other indicators of environmental noise include those involving education, safety, psychology, social science, politics, and economics.

Maas, R. B.
COMPLICANCE WITH OSHA ON HEARING CONSERVATION
Environ Contr Safety Manage, v 142 n 6, Dec 1971, p 11-13

An indistrial hearing expert presents his views plus a step-by-step program of action to the new Occupational Safety and Health Act of 1970 rules on noise control and hearing conservation.

McRobert, H.; Ward, W. D.
DAMAGE-RISK CRITERIA: THE TRADING RELATION BETWEEN INTENSITY AND THE NUMBER OF NONREVERBERANT IMPULSES
J Acoust Soc Amer, v 53 n 5, May 1973, p 1297-1300

An analysis was made of the role of impact and impulse noises in hearing damage-risk criteria. Data suggest that the correct trading relation for exposures involving impulsive noise is a function of the degree of reverberation associated with the exposure. The invalidity of damage-risk criteria expressed only in terms of pulse peak level is emphasized.

Pell, S.
AN EVALUATION OF A HEARING CONSERVATION PROGRAM--A FIVE YEAR LONGITUDINAL STUDY
Amer Ind Hyg Conf (San Francisco, Calif, May 14-19, 1972)

A long-term study of noise and hearing loss was undertaken in the Du Pont company to evaluate the company's hearing conservation program. About 30,000 men and women, of whom about 7,000 work in areas where noise levels are above the company's hearing conservation criteria, were studied. Findings of changes in hearing threshold levels over a five year period are presented. Changes among nonexposed workers are compared with those among workers in two levels of noise exposure.

Tomlinson, R. W.
ESTIMATION AND REDUCTION OF RISK TO HEARING. THE BACKGROUND AND A CASE STUDY
Appl Ergonomics, v 2 n 2, June 1971, p 112-119

For noise exposure varying in both level and duration, current noise criteria are inadequate, but by adapting methods presently available, an equivalent continuous level can be calculated from which the risk to hearing can be assessed. The predicted effects on hearing compare favorably with measured values. These methods are used to predict an "acceptable noise limit for the variable noise environment on the agricultural tractor." Methods of noise reduction for the tractor are outlined along with other approaches to hearing preservation. 14 refs,

Industrial Noise -

Scott, C. E., III; Royster, L. H.; Thomas, W. G.
COMPARISON OF SELECTED DAMAGE RISK CRITERIA IN JUDGING INDUSTRIAL NOISE ENVIRONMENTS
Acoust Soc of Amer, J, v 51 n 1, Jan 1973, p 291-392

Over 500 industrial noise data samples were studied for the purpose of comparing allowed exposure times using 85 dBA, 90 dBA, and octave band spectra with the Chaba working group damage risk contours. The use of octave band data spectra and the Chaba working group damage risk contours should be allowed in lieu of overall dBA.

Tracor, Inc.
GUIDELINES ON NOISE
Amer Petroleum Inst, Div of Environ Affairs, Medical Res Rep, EA 7301, 1973

Noise limits which will reduce the probability of hearing damage, minimize disturbance of communities, and enable effective speech communication are specified. These limits will provide designers and planners with a set of design criteira which can be used for systems analyses to determine optimum equipment selection, plant layout, and siting of plants and facilities. The procedures for the measurement of airborne sound under a variety of conditions are outlined, so that a systematic approach to the acquisition of sound data is developed which ensures that accurate and complete information concerning a noise question can be obtained. A compilation of noise control information design to equip the project engineer with tools to solve many noise problems and to approach these problems intelligently is presented. This compilation includes basic elements of acoustics, plant design, noise control through equipment specifications and noise control design and techniques.

Tuts, P.
LAWAAIBESTRIJDING IN DE INDUSTRIE (NOISE ABATEMENT IN THE INDUSTRY)
Ingenieursblad, v 42 n 9, May 1, 1973, p 253-259

Discussion of various measures for the abatement of the noise to which a worker is subjected at his work station. The efficiency of the means of noise abatement applied to a person exposed to noise, to the noise source, and to the immediate neighborhood of this source is examined. In Dutch.

Exposure

Botsford, J. H.
RELATION OF HEARING IMPAIRMENT TO NOISE EXPOSURE AND AGE
Amer Ind Hygiene Conf (San Francisco, Calif, May 14-19, 1972)

An equation relating prevalence of impaired hearing to age and noise exposure is based on the assumptions that the probability of developing impaired hearing at any age is proportional to the fraction of the population of that age which has already developed impaired hearing. The probability of impairment is also proportional to the fraction of the population remaining unimpaired and, therefore, is available for impairment. The solution of the differential equation resulting from these assumptions reveals a complex relationship of age and noise exposure to impairment. The effects of age and noise are not simply additive as is often assumed.

Kamperman, G.
NEW TECHNIQUE FOR EVALUATING PERSONAL NOISE EXPOSURE
Natl SAE News, v 109 n 1, Jan 1974, p 76-79

A statistical approach to industrial noise surveys can establish the magnitude of the over-all problem. Define source characteristics through frequency spectra, and establish the temporal character of the noise exposure from which major fluctuating noise sources can be defined. The technique replaces the inaccurate method of using dosimeters on workers to measure average noise fluctuation levels.

Leasure, W. A., Jr.
PERFORMANCE EVALAUTION OF PERSONAL NOISE EXPOSURE METERS
S/V Sound Vib, v 8 n 3, Mar 1974, p 36-40

The promulgation of federal occupational noise exposure regulations has resulted in a proliferation of personal noise exposure meters. A wide variation in performance has been observed among the various instruments. Test results of noise exposure meters are presented and evaluated at various levels of sound. 3 refs.

Lipscomb, D. M.
NOISE EXPOSURE AND ITS EFFECTS
Oticongress 2 (n.p.), 1972

The effects of noise-induced hearing loss upon total communication skills are discussed. Research implications are offered which point to the widespread cochlear damage occasioned by exposure to high intensity noise. This damage configuration is suggested as a reason noise-induced hearing loss cases generally complain of communicative problems which are not commensurate with their audiometric test results. A suggestion is made for measuring speech discrimination in varying signal-to-noise ratios.

Van Atta, F. A.
FEDERAL REGULATION OF OCCUPATIONAL NOISE EXPOSURE
S/V Sound Vibr, v 6 n 5, May 1972, p 28-31

The objectives of the United States Department of Labor in controlling occupational exposures are explained. They are to prevent hearing impairment resulting from occupational noise exposure in a large percentage of the working population. These goals are being approached through measurement of environmental noise, noise reduction where necessary or ear protection as a final resort. Periodic hearing tests are recommended to check on the efficiency of these control measures.

Impulsive Noise

Temporary Threshold Shift -

Mc Robert, H.; Ward, W. D.
TEMPORARY THRESHOLD SHIFT FROM IMPULSES
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Temporary threshold shifts were measured for seven listeners after exposure to clicks (one every 3.0 sec) at certain peak levels for varying amounts of time. First, a critical exposure condition was arrived at for each listener, the criterion for this exposure being that combination of peak level and exposure time that would produce 20 dB of TTS 0.5 (temporary threshold shift 30 sec after termination of the exposure) at 4 kHz. For two of the listeners, exposure at a peak level of 150 dB for 1 min (20 clicks) was sufficient to produce the required TTS. Four required 152 dB, while the two remaining listeners required 155 dB. Following this, each listener was exposed to clicks at lower peak levels (on different occasions at least 24 hr apart). At each level, the exposure time was increased to maintain equal energy during exposure. For each subject, the lower-level exposure produced significantly less TTS. Thus equal amounts of exposure energy do not necessarily lead to equal auditory hazards, at least for impulse noise.

Sitler, R. W.; Henderson, D.; Hamernik, R. P.
THE TEMPORARY AND PERMANENT THRESHOLD SHIFTS PRODUCED BY THREE LEVELS OF IMPULSE NOISE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Monaural chinchillas (15) were exposed to 50 impulses of either 155 or 161 or 166 dB peak sound pressure level. The impulses were generated by a shock tube and has a duration of 1 msec. Quiet threshold was measured at 0.25, 0.5, 1, 2, 4, and 8 kHz using the average evoked response technique. Recovery was monitored for 31 d. The median permanent threshold shift (PTS) for all frequencies was determined by the level of the impulse: the 155 dB level produced essentially no PTS, the 161 dB level produced approximately

10 dB PTS across all frequencies, and the 166 dB level produced 13 to 35 dB PTS. For moderate to severe TTS, as much as 14 hr were necessary to reach maximum TTS. Unlike TTS results, TTS max was not strictly determined by the level of the impulse. Specifically the correlation between the PTS and TTS max ranged from only $r = 0.34$ or $r - 0.75$. The results are discussed in reference to existing damage risk criteria for impulse noise.

Susceptibility to Damage -

Koestler, A. G.; Farrer, D. N.; Pegram, G. W.; Krausman, P. R.
THE BEHAVIORAL EFFECTS OF CHRONIC EXPOSURE TO IMPULSIVE NOISE IN CHIMPANZEES
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Two young male chimpanzees were exposed to 24 impulsive noises each night for 20 consecutive nights. The subjects' daytime performance on a temporal discriminative task was significantly poorer than preexposure performance standards. Although a general trend towards recovery became evident the subjects never fully regained consistent preexposure levels of performance. The data suggest that chronic nocturnal exposure to impulsive noise has a significantly detremental effect on the behavioral effectiveness of performing subjects.

Luz, G. A.; Lipscomb, D. M.
SUSCEPTIBILITY TO DAMAGE FROM IMPULSE NOISE: CHINCHILLA VERSUS MAN OR MONKEY
Acoust Soc of Amer, J, v 54 n 6, Dec 1973, p 1750-1754

Behavioral audiograms were taken on five surgically monaural chinchillas at 0.75, 1.5, 4.0, 6.0, 7.9, 11.0, 14.5, and 16.5 kHz. After exposure to 1-4 impulses of 168 dB peak SPL and 60- sec a-wave duration, temporary threshold shift was monitored at 1.5, 6.0, and 14.5 kHz for 32 d and complete audiograms taken at 64 d postexposure. Shifts were similar to those found by other researchers who have exposed the chinchilla to similar impulses, but were larger than those seen in monkeys and men exposed to the same impulse noise source. Conchlear hair cell losses for the five subjects exposed to 1-4 impulses were small and not significantly different from those of five others exposed to 10-40 impulses (but not tested behaviorally). The conclusions paralleled those of Hunter-Duvar and Elliott in that stimulation sufficient to produce permanent threshold shifts of 10-20 dB may not produce anatomical injuries to the organ of corti that are detectable by phase microscopy. Caution was urged in generalizing the results of impulse noise studies in chinchilla to human damage risk criteria. The use of preexposure impedance measures to rule out middle ear conductive losses was also suggested for future studies.

Perceived Levels and Differences -

Abel, S. M.
DURATION DISCRIMINATION OF NOISE AND TONE BURSTS
J Acoust Soc Amer, v 51 n 4 Pt 2, Apr 1972, p 1219-1223

An experimental study is made of the human observer's ability to discriminate a difference in duration for noise bursts and gated sinusoids. Results best agree with the type of neural counter model proposed by Creelman which suggests a central process for measuring duration that is independent of the nature of the stimulus.

Stevens, S. S.
PERCEIVED LEVEL OF NOISE BY MARK VII AND DECIBLES (E)
J Acoust Soc Amer, v 51 n 2 Pt 2, Feb 1972, p 575-601

The Stevens Mark VI procedure for calculating the perceived level of loudness or noisiness is modified to bring the calculation system into closer alignment with the behavior of the auditory system in the subjective evaluation of acoustic energy. The calcualtion uses a set of frequency weighting contours based on an average of 25 experimental contours. The Mark VII version is extended to lower frequencies to facilitate calculation of the perceived level of impulses and sonic booms. 60 refs.

Pathological Effects -

Unterreiner, R.; Richard, M.; Lafon, J. C.
L'ACTION PATHOLOGIQUE DES BRUITS IMPULSIONNELS, EXPERIMENTATIONS ET RESULTATS (EXPERIMENTS AND RESULTS ON THE PATHOLOGICAL EFFECT OF NOISE PULSES)
Acustica, v 30 n 2, Feb 1974, p 100-108

In order to avoid the disadvantages characteristic to conventional measuring methods - sound level meter, oscilloscope - an apparatus especially designed for very short intensity sound pulses, was developed, enabling to show the peak energy periods of the sound pulses and to establish objective criteria of their harmfulness. 12 refs. In French.

Cochlear Degeneration -

Hamernik, R. P.; Henderson, D.; Sitler, R. W.
CONCHLEAR DEGENERATION FOLLOWING IMPULSE NOISE EXPOSURE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Twenty guinea pigs were exposed to permanent threshold shift (PTS) producing impulses of either 166 or 161 dB peak sound pressure level. The animals were sacrificed at postexposure times of 60 min to 50 d, and the cochleas were histologically examined. At 60 min postexposure, hair-cell lesions are observed without phalangeal scars. The lesions are bordered on both sides by greatly swollen and distorted hair cells. This damage is observed to increase in extent for up to 30 d. Atrophic changes in the stria vascularis are seen in regions adjacent to the hair cell lesions. Atrophy of the capillaries of the spiral ligament and swelling of the endothelial cells of the vas spiralis appear but are not specific to the hair cell lesions. Other changes include loss of supporting cells, collapse of the tunnel of corti, degeneration of the limbus, and loss of nerve fibers. These experiments present a paradox; over a period of 30 d the cellular damage grows progressively worse while presumably, hearing sensitivity is recovering.

Effects of Noise on Sleep

Thiessen, G. J.
EFFECT OF NOISE ON SLEEP
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 291-392

When appropriate account is taken of duration of the stimulus the present data on interference of sleep by noise seen to present a consistent picture. This picture indicates a threshold of interference which varies inversely with the duration of the stimulus, while for a given stimulus length the probability of a shift in sleep level is proportional to the stimulus level. The slope of this line seems approximately independent of stimulus duration. Thus, when all the available data are combined, they appear to contradict previous statements that for sonic booms and other acoustics stimuli of short duration there is practically no dependence on intensity once the threshold of sleep disturbance is exceeded. There is still no evidence that any appreciable habituation exists.

Intermittent Noise

Anderson, C. M. B.; Robinson, D. W.
THE EFFECT OF INTERRUPTION RATE ON AN INTERMITTENT NOISE
Teddington, Eng. Natl Phys Lab, Acout Rep n 53

An experiment designed to test a prediction made from the noise pollution level (LNP) formulation is described. During each test session of 30 min subjects were exposed to 15 min of road drill noise at 87 dBA, the experimental variables being the number and duration of the noise bursts. The results were broadly consistent with the formula when compared with experiments using steady noise, but secondary effects are found which depend on the intermittancy rate. The results are used to illustrate a psychophysiological model of noise annoyance, and are also discussed in relation to the noise fluctuation term in the LNP formula. Of the personality indices taken, extraversion was the only measure to show significant effects.

Conrad, D. W.
EFFECTS OF INTERMITTENT NOISE ON HUMAN SERIAL DECODING PERFORMANCE AND PHYSIOLOGICAL RESPONSE
Ergonomics, v 16 n 6, Nov 1973, p 739-747

The effects of continuous, periodic, and aperiodic broad band noise on serial decoding performance and on three physiological response measures were investigated. Performance data were recorded from 16 undergraduate university students using an electronically programmed rapid serial decoding task. The task configuration chosen combined a basic serial reaction function with a mental coding and short-term memory function. To assess activation or arousal effects of noise, three physiological variables were also simultaneously recorded: finger photoplethysmographic blood volume pulse amplitude, pulse rate, and forearm electromyogram. Each subject was isolated in a soundproof chamber while performance data and physiological data were collected under four counter-balanced conditions: work in quiet, continuous noise, periodic noise, and aperiodic noise. A sound intensity level of 93 dBA broad band noise was used in all noise conditions. The results showed a significant relationship between a subjective measure of noise annoyance sensitivity and a measured physiological variable, photoplethysmographic blood volume pulse amplitude. 24 refs.

Fuller, H. C.; Robinson, D. W.
SUBJECTIVE REACTIONS TO STEADY AND VARYING NOISE ENVIRONMENTS
Teddington, Eng Natl Phys Lab, Acoust Rep AC 62, Aug 1973

Two experiments are described in which adverse subjective reaction to experimental moises was scored by multi-item questionnaires following exposure periods of 30 min. In the first experiment, reaction to a steady noise was related to noise level in a resonably linear manner over the range 60-95 dBA. The second experiment examined subjective reaction to a steady noise with peaks of a louder noise superimposed on it. Six configurations of this type were tested, and the results are discussed.

Repko, J. D.; Loeb, M.
EFFECTS OF CONTINUOUS AND INTERMITTENT NOISE ON WORK BEHAVIOR
Acoust Soc of Amer, J, v 53 n 1, Jan 1973, p 291-392

A synthetic work approach was employed in an investigation of the effects of 90 dB continuous and periodic 96 dB intermittent broad band noise on human performance. Ten Navy and Air Force ROTC cadets worked the tasks of a multiple-task performance battery 12 hr/wk (in 3, 4-hr sessions) during a 4-wk training period. Subsequently, they were required to work 4 d, 8 hr/d on a split-shift schedule during the presence of noise and finally, work two additional days on the same split-shift schedule under quiet conditions. Mean percentage of baseline performance (a composite index of performance) was enhanced by a periodic 96 dB intermittent noise, and the extent of the effect varied as a function of the number of tasks concurrently performed in the work situation. On the other hand, 90 dB continuous noise neither enhanced nor degraded performance.

Aircraft Noise Related

Effects on Sleep -

Le Vere, T. E.; Bartus, R. T.; Hart, F. E.
ELECTROENCEPHALOGRAPHIC AND BEHAVIORAL EFFECTS OF NOCTURNALLY OCCURRING JET AIRCRAFT SOUNDS
Aerospace Med, St. Paul, Minn, v 43 n 4, April 1972, p 384-389

Data relative to the objective evaluation of the effects of a specific complex auditory stimulus during sleep are presented. The auditory stimulus was a jet aircraft flyover of approximately 20-sec duration and a peak intensity level of approximately 80 dBA. The physiological effects (changes in electroencephalographic. EEG, activity) produced by the jet aircraft stimuli outlasted the physical presence of the auditory stimulti by a considerable degree. Both behavioral and EEG changes were noted during waking performances subsequent to nights disturbed by the jet aircraft flyovers which were not apparent during performances subsequent to undisturbed nights. Even limited exposure to nocturnal stimuli which do not necessarily produce behavioral awakening can nonetheless produce significant changes in an individual's pattern of sleeping and waking EEG and overt waking performance.

Lukas, J. S.; Dobbs, M. E.
EFFECTS OF AIRCRAFT NOISES ON THE SLEEP OF WOMEN
NASA Contract Rep n CR-2041, June 1972

The electroencephalographic and behavioral responses during sleep of eight women subjects, aged 29 to 49 years, to subsonic jet flyover noise and simulated sonic booms were tested over 14 consecutive nights. It was found that the women were awakened, on the average, by approximately 42 percent of the flyover noises and by approximately 15 percent of the simulated sonic booms. Comparison of the results of this study with those of a similar study using men as subjects revealed that women were awakened more frequently by the subsonic jet flyover noise than were the men, while men were awakened more frequently by the simulated sonic boom.

Lukas, J. S.; Peeler, D. J.; Dobbs, M. E.
AROUSAL FROM SLEEP BY NOISES FROM AIRCRAFT WITH AND WITHOUT ACOUSTICALLY TREATED NACELLES
NASA Contract Rep n CR-2279, July 1973

Sleep disruption of subjects, due to aircraft noise, was tested at nominal intensities of 61 and 79 dBA. The results indicate that for an equivalent degree of sleep disruption, noise from the jet aircraft with untreated nacelles must be about 6 dBA less intense than the jet with acoustically treated nacelles. Highest accuracy on the effects of noise on sleep is realized when the physical descriptor of noise intensity includes information about the "impulsive" characteristics of that noise as well as its long-term spectral content. 17 refs.

Disturbance Predictions -

Hazard, W. R.
PREDICTIONS OF NOISE DISTURBANCE NEAR LARGE AIRPORTS
J Sound Vib, v 15 n 4, Apr 22, 1971, p 425-445

Relationsip between public annoyance with aircraft noise, objective measures of the noise itself, and mediating social or psychological conditions which affect the noise-annoyance relationship are examined. 15 refs.

Acuity -

Froehlich, G. R.
HEARING ACUITY IN RELATION TO AGE AND FLYING TIME
AGARD Conf Proc n 81, Two Specialists Meetings of Aerospace Med Panel Sept 21-22, 1970, Garmisch-Partenkirchen, West Germany, Mar 1971, Paper 19

Sonic Boom -

Carothers, R.
INITIAL CALIBRATION AND PHYSIOLOGICAL RESPONSE DATA FOR THE TRAVELING-WAVE SONIC-BOOM SIMULATOR
Toronto Univ., Inst Aerospace Stud, UTIAS Tech Note, n 180, Aug 1972

To allow the study of sonic-boom phenomena and to establish how it relates to the Canadian situation, two sonic-boom simulation facilities have been designed and built at the University of Toronto Institute for Aerospace Studies. This report deals with the initial calibration of one of these facilities: the traveling-wave horn-typesonic-boom simulator, and presents the results of tests showing the effects of sonic booms on human heart rate and hearing. 20 refs.

Lips, K. W.
UNSTABLE STEERING TASK WITH A SONIC-BOOM DISTURBANCE
Toronto Univ, Inst Aerospace Stud, UTIAS Tech Note n 179, Sept 1972

An initial study was made concerning the effect of sonic boom distrubances on an individual's compensatory tracking performance for an unstable system. In certain respects the tracking task simulated automobile driving. It was found that most individuals were disturbed and recovered in varying degrees. These preliminary results, although somewhat qualitative, show that useful data can be obtained from this type of simulation. 8 refs.

Lukas, J. S.; Dobbs, M. E.; Peeler, D. J.
EFFECTS ON MUSCLE TENSION AND TRACKING TASK PERFORMANCE OF SIMULATED SONIC BOOMS WITH LOW AND HIGH INTENSITY VIBRATIONAL COMPONENTS
NASA Contract Rep CR-1781, June 1971

To determine the relative contribution of the vibrational component generated in a room from simulated sonic booms on the electromyographic and performance responses of human subjects, four subjects were assigned to each group-paced tracing task, with booms and with relatively low intensity vibration (subject's chair and tracing table on a vibration-isolation platform); paced tracing task, with booms, and with relatively high intensity vibration (subject's chair and tracing table on floor); reading of light material, with booms, and with low intensity vibration. 15 refs.

Smith, R. C.; Hutto, G. L.
SONIC BOOMS AND SLEEP: AFFECT CHANGE AS A FUNCTION OF AGE
Aerospace Med, v 44 n 7, July 1973, p 703-707

This study concerned the measurement of mood changes resulting from simulated sonic booms occurring during sleep. Subjects from 3 age groups (21-26, 40-45, and 60-72 yr old) spent 21 consecutive nights in a sleeping room equipped for sonic boom simulation. During the 6th through 17th nights, simulated sonic booms of 1.0 psf outdoors overpressure level (0.1 psf measured inside the sleeping rooms) were presented hourly throughout each night. As the measure of mood, the subjects completed a composite mood adjective checklist in the evening before retiring and in the morning after waking on each of the 21 d. No change in moods attributable to the occurrence of simulated sonic booms was found.

Thackray, R. I.; Touchstone, R. M.; Jones, K. N.
EFFECTS OF SIMULATED SONIC BOOMS ON TRACKING PERFORMANCE AND AUTONOMIC RESPONSE
Aerospace Med, St. Paul, Minn, v 43 n 1, Jan 1972, p 13-21

Subjects were exposed to four simulated sonic booms over an approximate 30 min period. Subjects performed a tracking task during the exposure period and continuous recordings were obtained of heart rate and skin conductance. No evidence of performance impairment was found for any of the overpressure levels. Rather, performance improved significantly following boom simulation along with heart-rate deceleration and skin conductance increase. However, due to variable factors, care should be taken to avoid drawing unwarranted conclusions, relative to general sonic boom effects, on the basis of these findings alone.

Psychological Effects

Anderson, C. M. B.; Whittle, L. S.
PHYSIOLOGICAL NOISE AND THE MISSING 6 DB
Acustica, v 24 n 5, May 1971, p 261-272

A series of experiments is described which confirms the existence of the 'percent' missing 6 dB 'percent' effect. This is shown to consist of a frequency and level dependent discrepancy between free-field and pressure thresholds at frequencies below 1000 Hz. The effect is demonstrated as being caused by the physiological noise produced under a supra-aural earcap. The physiological noise is shown to be vascular in origin, and to be generated within the external auditory meatus. Some practical implications are discussed. 24 refs.

Buchwals, J.
THE PHYCHOLOGICAL EFFECTS OF NOISE
Noise in the Environ; Causes, Effects, Controls, conf, Papers (Toronto, Ont, Can, April 28-29, 1971)

The influence of excessive noise on mental health is discussed. The effects of noise on work, play, and vital functions are discussed. Noise stimuli may cause the reemergence of repressed trauma, and preconscious awareness of persisting noise can culminate in symptoms of stress and/or outbursts of ego-alien activity. Case studies are cited, and individual and group attempts at noise control are considered.

Forshaw, S. E.
THE PHYSIOLOGICAL EFFECTS OF NOISE
Noise in the Environ; Cuases, Effects, Controls, Conf., Papers (Toronto, Can, April 28-29, 1971)

The physical properties of sound and the means by which they are specified and measured are described. The structure and functions of the ear are depicted, and the measurement of hearing sensitivity is characterized. Pathologies of the ear are discussed, and hearing loss is classified into four basic bypes: conductive, sensorineural, central, and functional. Conductive hearing loss can be caused by a single exposure to an intense sound impulse, but the most prevalent type of noise-induced pathology is sensorineural. Nonauditory effects of noise include vertigo, nausea, nystagmus, and loss of equilibrium.

Jeffress, L. A.
LOGISTIC DISTRIBUTION AS AN APPROXIMATION TO THE NORMAL CURVE
J Acoust Soc Amer, v 53 n 5, May 1973, p 1296

For psychophysical claculations with a small computer lacking an error-function routine it is shown that logistic distribution yields a satisfactory approximation to the normal probability function. Application is to statistics of optical and acoustical signal recognition by human observers.

Olson, H. F.
PSYCHOLOGY OF SOUND REPRODUCTION
Audio, v 56 n 6, June 1972

The purpose of this paper is to present an exposition on the psychology of sound reproduction involving the psychology of music, speech, hearing, distortion, noise, and spatial phenomena.

Rentzsch, M.
EINFLUSS VON LAERM AUF EINE KOMBINATION GEISTIG-KOERPERLICHER TAETIGKEITEN UNTER BETRIEBSBEDINGUNGEN (INFLUENCE OF NOISE ON A COMBINATION OF INTELLECTUAL AND PHYSICAL ACTIVITIES UNDER OPERATING CONDITIONS)
Wiss z Tech Univ, Dresden, v 21 n 3, 1972, p 567-572

The influence of noise on man's working capacity is investigated on the example of an all-purpose shovel-crane. The experimentally obtained data are tested by means of multiple analysis of variance and further statistical test methods. Finally, the effect of noise on working capacity is considered from the economic aspect. In German.

Schumacher, R.; Crone, J.; Luescher, E.
LAERM - DEFINITIONEN UND MESSUNGEN, WIRKUNGEN UND MINDERUNGSMASSNAHMEN. EINE UEBERSICHT. (NOISE - DEFINITIONS AND MEASUREMENTS, EFFECTS AND MEANS FOR ABATEMENT. AN OVERVIEW)
Fortschr-Ber VDI-Z Pt 11 n 12, July 1972

Psycho-and physiological effects of noise point to the necessity of establishing hygienically based, critical limits of noise. Paper confronts these values with laws and regulations in effect, in order to expose the still existing discrepancy in their evaluation. That discrepancy is even more evident in A, contained in paper, representation of actually occurring in large cities noise intensities such as in: vehicular or aircraft transportation, residential noise, etc. In parallel paper examines means for abatement of noise. In conclusion paper outlines criteria that should be considered in discussion of noise, surveys and registers. Paper aims at reaching urbanistic planners, transportation experts, and communal authorities, for whose benefit a catalog of various preventive measures is included. 62 refs. In German.

Sommer, H. C.; Harris, C. S.
COMBINED EFFECTS ON NOISE AND VIBRATION ON MENTAL PERFORMANCE AS A FUNCTION OF TIME OF DAY
Aerospace Med St Paul, Minn, v 43 n 5, May 1972 p 479-482
Abs, 4 figs, 3 refs, from AA.

To determine combined effects of noise and vibration on mental performance as a function of time of day. Ten subjects were randomly exposed to each of the following conditions: stress (5 ha vibration 0.25 G_Z, 110 dB noise) at 6:00 a.m.; no stress (no vibration - 85 dB noise) at performance on a mental arithmetic task was measured during each of these exposures on consecutive days. Significant interaction between time of day and stress was due to both a slight improvement in performance in no stress condition at 3:00 p.m., and a slight decrement in performance at 3:00 p.m. in the stress condition. Results suggest that phase of the circadian cycle may be a variable to be considered in studies on the effects of stress on human performance.

Intense Noise

Ando, Y.; Hattori, H.
STATISTICAL STUDIES ON THE EFFECTS OF INTENSE NOISE DURING HUMAN FETAL LIFE
J of Sound and Vibr, v 27 n 1, Mar 8, 1973, p 101-110

The manner in which infants react to aircraft noise was investigated. The babies born of mothers who came to a noisy area before or during the first 5 months of pregnancy showed little or no excitability to the noise. There were 188 babies in the first study. More than 1,000 subjects, including low-birth-weight infants, were chosen to replicate the work. The birth-rate- of low-birth-weight babies increased as the noise level increased.

Desai, D. D.
ENVIRONMENTAL POLLUTION DUE TO NOISE
Environ Pollut & Its Control (Baroda, India, Apr 15-17, 1971), Inst of Engr (India), Baroda Sub-Centre.

The anatomy of the human ear and the behavior of man and animals in an exceedingly noisy environment is discussed. The effect of distance on sound levels and sound-intensity level phenomena is considered in studying the noise problem acoustically. Several protective and preventive measures for industrial workers and people associated with noisy machienry are suggested. It is recommended that the noise problem be studied psychologically as well as statistically.

Lipscomb, D. M.; Roettger, R. L.
CAPILLARY CONSTRICTION ON COCHLEAR AND VESTIBULAR TISSUES DURING INTENSE NOISE STIMULATION
Laryngoscope, v 83 n 2, Feb 1973, p 259-263

One of the physiological reactions to intense sound stimulation is a reduction in blood volume in the skin. This effect is considered to be secondary to vasoconstriction in response to sound. Some of the ways in which cardiovascular reactions might be evidenced in the inner ear tissues were investigated. Specifically, capillary constriction in vestibular and cochlear tissue of rats was noted in response to stimulation with high level sound. Reduciton of the internal capillary diameter appeared to be caused by the thickening of capillary walls by the accumulation of nuclear masses. This constriction of blood flow is considered to be one factor in noise trauma reactions.

Price, G.; Richard, J.
FUNCTIONAL CHANGES IN THE EAR PRODUCED BY HIGH-INTENTIY SOUND - 2. 500-HZ STIMULATION
Acoust Soc Amer, v 51 n 2, part 2, Feb 1972, p 552-558 A

An experimental study was made of changes in the cochlear microphonicelectrophysiological potential as a function of sound exposure. Data for a 500 Hz tone for 80 min stimulation to ears of 36 cats is interpreted in terms of damage-risk criteria for the human ear. 13 refs.

Annoyance

Angevine, O. L., Jr.
INDIVIDUAL DIFFERENCES IN THE ANNOYANCE OF NOISE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-288

Among the factors influencing individual appraisals of noise intrustion and annoyance are the information contained in the noise, the person's conditioning, and his interpretation of what the noise represents. His previous adaptation to the noise, and his expectation as to the level and the difficulty of quieting it also affect his estimate. Cultural differences in conversational voice level and speaking distance affect the evaluation of the background noise. Daily and monthly rhythms occur in the sensitivity. All of these factors serve as a caution that the individual response may depart from the average reaction.

Burns, W.
NOISE AND MAN
Second Ed, Philadelphia, Pa, J. B. Lippincott Co, 1973

Many problems arise from noise: annoyance; inteference with conversation, leisure, or sleep; effects on the efficiency of work; and potentially harmful effects, particularly on hearing. These problems may arise in a wide variety of situations, where they may have to be considered, at least initially, by those who could not reasonably be expected to be expert in the subject. The problems of noise generation and the effects on human hearing are discussed. The physical properties of sound, the types of sound, and the measurement, deafness, disturbance, temporary and permanent effects of noise on hearing, preservation of hearing, aircraft noise, and impulse noise are considered.

Hayre, H. S.
MODEL OF PSYCHOLOGICAL ANNOYANCE OF NOISE
IEEE Southeast-Conf Proc, reg 3 Conf, Louisville, Ky, Apr 30 - May 2, 1973
Paper A-4, Publ by IEEE (73 CH0725-2 Reg III), New York

An attempt is made to deduce heuristic mathematical models of psychological annoyance of noise with varying pitch, duration, spectral width, volume, as well as discrete frequency. Effects are derived based on the physical, audiology, nerve and brain system response with appropriate attention to saturation characteristics of each subsystem, and their interaction. This is believed to offer a desirable avenue so far as noise pollution is concerned since a fantastic amount of data has been collected without any direct relationship with annoyance. 15 refs.

Rahlfs, V. W.; Schaaf, A.
PSYCHOMETRIC STUDY OF NOISE ANNOYANCE (EINE PSYCHOMETRISCHE UNTERSUCHUNG DER LAESTIGKEIT VON GERAEUSCHEN)
Acustica, v 24 n 6, June 1971, p 340-346

Annoyance values of laboratory generated complex sounds were determined by a pure psychological scaling method and correlated with their physical parameters by the help of multiple regression technique. Sound stimuli consisted of a broad-band noise with a superimposed narrow-band component, the location and intensity of which were systematiclaly varied. The psychophysical relations could be expressed in the form of a simple equation. 19 refs. In German with English Abstract.

Loudness

Galambos, R.; Bauer, J.; Picton, T.; Squires, K.; Squires, N.
LOUDNESS ENHANCEMENT FOLLOWING CONTRALATERAL STIMULATION
J Acoust Soc Amer, v 52 n 4, Pt 2, Oct 1972, p 1127-1130

Experiments show that the apparent loudness of a tone pip can be increased by 15 dB or more under certain conditions if it is preceded by a tone burst to the contralateral ear. The subject first receives a signal in one ear, followed by two successive signals to the other ear and adjusts the intensity of the second until it sounds as loud as the first. Some parametric explorations of the loudness matching phenomenon are reported. 13 refs.

Glaser, E. M.; Haven, M.
BANDPASS NOISE STIMULATION OF THE SIMULATED BASILAR MEMBRANE
J Acoust Soc Amer, v 52 n 4, Pt 2, Oct 1972, p 1131-1136

Computer model simulation is used to study the relation between loudness summation and stimulus bandwidth arising from the motion of the basilar membrane and the stimulation of the sensory hair cells. The pattern of the rms envelope of membrane vibration is studied under various stimulus conditions. Results suggest that loudness phenomena may originate peripherally and may be associated with the extent of the basilar membrane simulated.

Hattler, K. W.; Stokinger, T. E.
LOUDNESS BALANCES EMPLOYING SIGNALS WTIH UNEQUAL DUTY CYCLES
J Acoust Soc Amer, v 52 n 2, Pt 2, Aug 1972, p 558-565

An experimental study was made to determine the effects of the percentage of time a 1000 Hz signal is turned on vs its perceived magnitude. The duty-cycle-loudness effects were enhanced when a 400 msec silent interval separated alternating tones. The relation of these results to the type-V Bekesy pattern in clinical audiology is shown and its importance pointed out for loudness adaptation experiments involving interrupted signals.

Howes, W. L.
LOUDNESS: HOW A HUMAN JUDGMENT IS QUANTIFIED
Instrum Control Sys, v 46 n 2, Feb 1973, p 73-75

Physical intensity of sound is defined and a formula is given. Psychoacoustic laws of loudness are presented. External and internal factors influencing perceived loudness level are considered.

Rowlery, R. R.; Studebaker, G. A.
LOUDNESS-INTENSITY RELATIONS UNDER VARIOUS LEVELS OF CONTRALATERAL NOISE
J Acoust Soc Aner v 49 n 2, Pt 2, Feb 1971, p 499-504

Using the method of numrical magnitude balance, auditory tests were made on effects of four levels of broad-band noise at the contralateral ear on the loudness of a monaurally presented 1000 Hz pure tone. The monaural loudness at low sound levels appears to be inversely related to the intensity of broad-band contralateral noise, and the loudness at moderate sound levels was directly related. 16 refs.

Stokinger, T. E.; Cooper, W. A., Jr.; Meissner, W. A.
INFLUENCE OF BINAURAL INTERACTION ON THE MEASUREMENT OF PERSTIMULATORY LOUDNESS ADAPTATION
Acoust Soc Amer v 51 n 2, Pt 2, Feb 1972, p 602-607 A

Erstimulatory loudness adaptation was measured by two methods that utilized varying quantities of simultaneous contralateral stimulation. Data support the hypothesis that the loudness adaptation depends on simultaneous binaural stimulation and is also related to the amount of that stimulation. The adaptation is concluded to be other than a monaural or a purely peripheral phenomenon.

Ventry, I. M.; Woods, R. W.; Rubin, M.; Hill, W.
MOST COMFORTABLE LOUDNESS FOR PURE TONES, NOISE, AND SPEECH

A comparative study was made of values of most comfortable loudness levels of pure tones, broad- and narrow-band noise, and connected speech to explore the effects of various signals on normal listeners. Pure tones and narrow-band noise gave highest sound power level values. 23 refs.

Weiler, E. M.; Loeb, M.; Alluisi, E. A.
AUDITORY ADAPTATION AND ITS RELATIONSHIP TO A MODEL FOR LOUDNESS
J Acoust Soc Amer, v 51 n 2, Pt 2, Feb 1972, p 638-643

New data confirmed predictions of significantly lower auditory adaptation when the test-tone intensity exceeds adapting-tone intensity. The predictions were based on Small's theory of coding physical intensity into loudness. The theoretical implications of the new results are discussed. 15 refs.

Wiley, T. L.; Small, A. M., Jr.; Lilly D. J.
MONAURAL LOUDNESS ADAPTATION
J Acoust Soc Amer, v 53 n 4, Apr 1973, p 1051-1055

Measurements of monaural adaptation at several suprathreshold levels for 500 and 4000 Hz were made with normal subjects. No evidence was found of loudness adaptation, indicating that adaptation effects previously observed in various forms of simultaneous stimulation apparently were due to binaural interaction. Possibly due to both central and peripheral influences. 16 refs.

Nonauditory Effects

Andreyeva-Galanina Ye, T. S.; Alekseyev, S. V.; Kadyskin, A. V.; Suvorov, G.A.
NOISE AND NOISE SICKNESS
NASA Tech Transl n TT F-748, July 1973

Special attention has been given to the effect of noise on the organ of hearing. Important data pertain to physiological research, including the questions of adaptation and fatigue. Changes in occupational hearing losses, caused by the prolonged effect of noise, are discussed. Data are given on the effect of an acoustic stimulus on the eye, motor analyzer,, on vibration sensitivity and the functional state of the vestibular analyzer, involuntary functions, and the cardio-vascular system. 413 refs.

Blosser, D. F.; Whitehead, J. L.; Barnes, B. W.
NONAUDITORY EFFECTS OF NOISE: A SELECTED ANNOTATED BIBLIOGRAPHY II
Univ of Texas at Austin, School of Commun, Center for Commun Res,
June 1972

The primary motivation for this bibliography was a need for an overview of the most current international research into extra-auditory effects of noise; items of research reported since January 1966, are included. Empirical studies were included in preference to reviews and commentary, except when the latter appeared in well-known or influential journals. References include the topics of surveys, general articles, physiological responses to noise, the effects of noise on speech communication, the effects of noise on mental performance and motor tasks, the effects of noise on sleep and subjective states, attitudes toward noise source and community reactions to noise, and response scaling.

Bryan, M. E.; Colyer, I.
NOISE, INTELLECTURAL TASK AND INTELLIGENCE
Acustica, v 29 n 4, Oct 1973, p 228-233

Deterioration of performance while carrying out an intellectual task, in traffic noise of peak level 80...90 dBA, appears to correlate significantly with the intelligence of the subject. The results of a laboratory experiment, in which forty students carried out intelligence tests of 30 min duration, both in quiet and in the noise, are described and discussed. Both the score and the number of questions attempted were reduced, in the noise, for those subjects of high intelligence, while those for subjects of lower intelligence actually improved. These findings could have important implications, for many workers in modern offices and for students taking part in certain practical examinations. 10 refs.

De Haan, V. S.
NOISE: POTENTIAL DANGER TO MAN: PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS. AN INDEXED BIBLIOGRAPHY 1960-72
Baltimore, Johns Hopkins Med Inst, Infor Ctr for Hearing, Speech, and Disorders of Human Commun, Dec 1972

A broad overview is provided of research into the effects and control of noise. The bibliography is organized into 12 sections in order to avoid having to review the whole mass of literature for specific areas of research: biological effects, animal studies, identification of hearing loss, economic aspects, environmetnal noise (airports, traffic, recreational), impulsive (sonic booms), occupational noise, dentistry, legal aspects, military noises, psychological effects, and conservation (prevention, control, standards).

Glorig, A.
NON-AUDITORY AND AUDITORY HEALTH EFFECTS OF NOISE EXPOSURE
Inst Environ Sci, Proc, 17th Annual Tech Meeting, Living in Our Environment, Los Angeles, Calif, Apr 26-30, 1971, p 287-292

As far as the physiological state is concerned, it is well known that noise from 75 dBA up will produce various temporary changes in the physiological state. The most important of these is a reduction in the size of the median and smaller arterioles. Some of the side effects of this phenomenon are an increase in pulse rate, a paling of the mucus membrane throughout the organism and an increase in respiration rate. 6 refs.

Kryter, K. D.
NON-AUDITORY EFFECTS OF ENVIRONMENTAL NOISE
Amer J of Public Health and the Nations Health, v 62 v 3, Mar 1972, p 389-398

Research information and ideas on the effects of noise on human beings aside from auditory aspects are discussed. Limitations on present knowledge are indicated and needed research is described.

Kubik, S.; Blazenkova, L.
COMPLEX INFLUENCE OF NOISE ON HUMAN ORGANISM
Noise 2000, Assoc International Contre le Bruit, Intl Congresses, 6th & 7th (London, Eng, May 1968 & Groningen, Neth, May 1970)

Complex effects of noise on the human organism (hearing, nervous system, circulatory system) were examined in people who are exposed to strictly defined noise for a long period. Ten young men averaging 20 yr of age were gradually exposed to noise of various frequencies in a reverberant room; sound pressure level was always 85 dB. Low- and Medium-frequency noise up to 1000 Hz did not cause a significant shift of the auditory threshold. The mean duration of reaction time was fundamentally longer after both a 2 hr and 4 hr exposure as compared with the basic reaction time, the value at rest. Eosinophils in peripheral blood were determined and blood pressure, pulse rate, and electrocardiogram were observed. Especially in the region of 4000 Hz, preliminary results indicate that the limit of highest admissible noise in places of work will have to be revised.

Nixon, D. W.
SOME EFFECTS OF NOISE ON MAN
SAE, Intersociety Energy Conversion Eng Conf, Boston, Mass, Aug 3-5, 1971

22 refs.

Walker, J. G.
HEARING CONSERVATION
Noise and Vibr Control for Indust, Conf (Bath, Eng, Apr 10-12, 1972)

The biological effects of noise can best be considered by classifying them into five categories: physical, psychological, physiological, pathological, and performance. Effects of noise on the ear and hearing practical effects of noise-induced hearing loss, and a hearing conservation program are discussed.

Masking

Bell, D. W.
EFFECT OF FRINGE ON MASKING-LEVEL DIFFERENCE WHEN GATING FROM UNCORRELATED TO CORRELATED NOISE
J Acoust Soc Amer, v 52 n 2, Pt 2, Aug 1972, p 525-529

Human binaural detection of a signal having 180 degree interaural phase difference in boradband correlated noise having no interaural phase difference was studied when broadband uncorrelated noise temporarily surrounded the 125 msec observation interval. Switching from uncorrelated to correlated noise before the observation interval, or delaying the switch back to uncorrelated noise after the interval, tended to restore the masking-level difference.

Hafter, E. R.
QUANTITATIVE EVALUATION OF A LATERALIZATION MODEL OF MASKING-LEVEL DIFFERENCES
J Acoust Soc Amer, v 50 n 4, Pt 2, Oct 1971, p 1116-1122

A comparative analysis is made of the lateralization model, in which binaural detection in those cases that produce a masking level difference is of a shift in the spatial focus locus of the auditory image. The shift presumably is a function of interaural time and intensity differences in the signal-plus-masker and is quantified as a weighted sum of the two. The model is applied to a broad range of experimental data and compared with the time-difference model of L. A. Jeffress and the equalization-cancellation model of N. I. Durlach. 17 refs.

Osman, E.
CORRELATION MODEL OF BINAURAL MASKING LEVEL DIFFERENCES
J. Acoust Soc Amer, v 50 n 6, Pt 2, Dec 1971, p 1494-1511

A quantitative functional model is presented for use to interpret empirical results on binaural masking level differences from experiments on detection of sinusoidal signals embedded in binaural noise. Equations are derived for these masking level differences with the restirction of equal noise levels at the two ears. Similarities and differences between this model and the euqalization-cancellation model are discussed in detail. 33 refs.

Schoeny, Z. G.; Carhart, R.
EFFECTS OF UNILATERAL MENIERES DISEASE ON MASKING-LEVEL DIFFERENCES
J Acoust Soc Amer, v 50 n 4, Pt 2, Oct 1971, p 1143-1150

Release from a masking experienced by 12 persons having Meniere's disease was compared to that for 12 normal-hearing persons. Those with the abnormal hearing experienced slightly greater absolute masking and less release from masking than did normal hearers. The former also showed a tendency for the reduction in masking level difference to be related to degree of loss in the affected ear.

Soderquist, D. R.; Lindsey, J. W.
PHYSIOLOGICAL NOISE AS A MASKER OF LOW FREQUENCIES: THE CARDIAC CYCLE
J Acoust Soc Amer, v 52 n 4 Pt 2, Oct 1972, p 1216-1220

An experimental study quantified the effects of the heartbeat on the detectability of a 100 Hz, 100 msec tone at absolute threshold. Maximum sensitivity occurred near 0.5 sec following the EKG R wave. The results were discussed in terms of physiological masking produced by the valve closures within the heart.

Watson, C. S.; Franks, J. R.; Hood, D. C.
DETECTION OF TONES IN THE ABSENCE OF EXTERNAL MASKING NOISE - 1. EFFECTS OF SIGNAL INTENSITY AND SIGNAL FREQUENCY
J Acoust Soc Amer, v 52, n 2, Pt 2, Aug 1972, p 633-643

Nonaural detection tests were made with 12 trained listeners on tone signals, 125 to 4000 Hz, in the absence of external masking noise. Results were consistent with a limitation imposed on auditory sensitivity by a "system noise" composed of noise in the ear canal at low frequencies and a low-level (-11 dB) component of unspecified origin at medium and high frequencies. 20 refs.

Wilbanks, W. A.
DETECTION OF A NARROW-BAND NOISE AS A FUNCTION OF THE INTERAURAL CORRELATION OF BOTH SIGNAL AND MASKER
J Acoust Soc Amer, v 49 n 6, Pt 2, June 1971, p 1814-1817

An experimental study of the mechanism by which the human binaural system acts as a correlational detector. In the case where a narrow-band signal is partially masked by continuous wide-band noise, results imply that sizable masking level differences are obtained when adding the signal to the noise results in a decrease in correlation between stimulus events at the two ears. 16 refs.

Measurement

Brammer, A. J.
PORTABLE INSTRUMENTATION FOR MONITORING SOUND PRESSURE LEVELS WITHIN THE EAR
SAE Prepr n 730814, for Meet, Sep 10-13, 1973

The sound pressure levels experienced by an individual exposed to noise can be obtained irrespective of the nature of the source or the presence of acoustic barriers by monitoring the sound field within the ear. The apparatus developed for this purpose consists of a miniature microphone located on the base of the concha connected to a lightweight instrument package strapped to the subject. The latter contains a modified cassette tape recorder, power supplies, and an oscillator used to record a calibration signal onto each tape and check the performance of the system. A pressure transformation is applied during analysis of the data to compensate for the frequency response of the components or to generate an equivalent sound field that would exist at the center of the head in the absence of the subject. Potential applications of the device include measuring the sound level experienced by operators of machines in use, evaluating the insertion loss of various forms of headgear, and assessing occupational exposures to noise.

Brammer, A. J.; Piercy, J. E.
IN-EAR MEASUREMENT OF NOISE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

A measure of the sound field at the base of the concha, obtained by using a miniature microphone located within the ear, provides information on the acoustical signal entering the ear canal. When combined with a portable tape recorder, the apparatus can be used to evaluate an individual's exposure to noise and appears to be particularly suited for use in directional sound fields that vary in the vicinity of the head. In order to compare the data obtained with existing criteria for hearing conservation, or sound level meter measurements in a diffuse field, a transfer function is used to produce the equivalent diffuse field subject. The device was used to measure the noise levels experienced by operators of snowmobiles and chain saws as a function of time, and the attenuation, in some cases amplification of sound, produced by some common form of crash helmet and headgear. An overall accuracy of ± 2 dB was obtained from 100 to 5000 Hz by using a spectrum shaper and a built-in calibration system.

Brinkmann, K.
AUDIOMETER-BEZUGSCHWELLE UND FREIFELD-HOERSCHWELLE (AUDIOMETER REFERENCE THRESHOLD AND FREE FIELD HEARING THRESHOLD)
Acustica, v 28 n 3, Mar 1973, p 147-154

The fixed hearing threshold values based on the ISO recommendation R 226 and R 389 for binaural hearing in a free sound field and for monaural hearing with the aid of a headphone are compared with one another. Thereby consideration is given to the free field response level of the headphone used for the threshold measurements. New hearing threshold evaluations in free field and with headphone vary in a single frequency test up to 4.5 dB from the ISO threshold value. The comparison of the results of these measurements gives a better agreement than the comparison of the two ISO hearing thresholds. 19 refs. In German, with English abstract.

Laws, P.
ENTFERNUNGSHOEREN UND DAS PROBLEM IM-KOPF-LOKALISIERTHEIT VON HOEREREIGNISSEN (AUDITORY DISTANCE PERCEPTION AND THE PROBLEM OF IN-HEAD LOCALIZATION OF SOUND IMAGES)
Acustica v 29 n 5, Nov 1973, p 243-259

Reports the results of sound pressure measurements carried out by means of a probe microphone in the ear-canals of a number of subjects which were stimulated in an anechoic room by loudspeakers or headphones. It can be seen from the results that the sound pressure signals at the eardrums, compared with the electrical signals at the input of the stimulated system, show linear distortions (attenuation and group delay) which for each explored stimulating system depend characteristically on frequency. Furthermore, the article deals with results of hearing experiments in which subjects stimulated as before by loudspeakers or headphone in anechoic space were asked to judge the distances of the sound images appearing. The most important results show that it is possible in case of headphone-reproduction to reduce considerably the increased relative frequency of "behind outside the head" or "in-head" judgments characterizing a given headphone and to gain simultaneously the relative frequency of "in front outside the head" judgments. 77 refs. In German.

Basch, M. W.
A WEARABLE POCKET NOISE DOSIMETER
Amer Ind Hygiene Conf (San Francisco, Calif, May 14-19, 1972)

A noise dosimeter that meets the ANSI type II sound-level meter standard and accumulates the OSHA percentage directly is discussed. The frequency response for noise dosimeters should be measured with one-third octave bands of random noise in a reverberant room since this is more repeatable and a better approximation for a device that will ultimately measure noise. These frequency response measures will show the effects of the proximity of the wearer. The dosimeter is composed of two parts: a small pocket unit that accumulates and stores the digital data representing the OSHA percentage and an indicator unit that provides a digital readout on a light emitting diode display. The pocket unit includes a small ceramic microphone, a true RMS detector with more than 15 dB crest factor capacity, and an extremely low-power MOS digital counter to store the OSHA percentage. It weighs 7 oz and runs for over 300 hr on an ordinary 9V transistor battery.

Bennett, W. K.; Blickwedel, T.; Pallies, W.
PERSONAL INTEGRATING SOUND LEVEL METER SYSTEM
IEEE Intercon Tech Paper 1973, for Meeting, New York, N.Y., Mar 26-30, 1973, v 7 Paper 36-3

Recent federal legislation requires employers to measure both the sound levels and exposure times of employees to sound levels over 90 dBA. Limits are imposed on exposure times for various levels. A system that continuously measures sound levels and elapsed time, and automatically integrates sound exposure is described. Application of the system and data interpretation are discussed. 5 refs.

Sacks, H. K.; Durkin, J.; Murphy, J. N.
NOISE MONITORING AND PERSONAL PROTECTION
Amer Ind Hygiene Conf (San Francisco, Calif, May 14-19, 1972)

A personal audio dosimeter was developed to monitor an individual's exposure to noise. The dosimeter is only 16 cubic inches and is carried in an individual's pocket. The batteries provide for two months operation and the unit features instantaneous readout of the percentage of maximum permissible exposure, true RMS detection, and a continuous weighting scale. The results obtained in field testing and performance criteria for such devices are discussed. An ear muff with miniaturized electronics to permit the wearer to hear low level signals while wearing the muff but protect him from levels in excess of 90 dBA is also described.

Singh, A. P.
WEARABLE NOISE DOSIMETER
Noise Control Vibr Reduct, v 4 n 6, Nov-Dec 1973, p 250-254

There is increasing evidence from several surveys that excessive noise causes not only hearing damage, acceleated deafness, severe physiological and psychological damage, but is also responsible to a considerable percentage of industrial accidents. Present accumulated information, through research and experience, identify the severity of three main factors: (a) sound level in dBA; (b) duration and distribution of noise exposure; (c) total exposure time. Surveys of potentially harmful noise, as in industrial areas, may be adequate if the employee remains in a given area all day and the noise level is constant. A more direct approach is to provide a "wearable noise dosimeter." Such a device is described. It consists of a ceramic microphone, a noise exposure monitor and a noise exposure indicator, and automatically measures and computes the total exposure. No exposure below 79 dBA is accumulated; once exposure to 120 dBA occurs; an indicator lamp lights. The performance of the device is compared with ISO (International Standards Organization) recommendations R1999 for "Assessment of Occupational Noise Exposure for Hearing Conservation Purposes."

Protection

Atherley, G. R. C.
CARE OF WORKERS EXPOSED TO NOISE
Soc of Environ Engrs, Environ Eng Aspects of Pollut Control, London, 1971, Symp held in London, England, June 22-23, 1971, Sect A, 2 p

The purpose of this paper is to describe the steps that are essential if risk of occupational deafness is to be predicted with reasonable precision for any particular noise. The principle underlying the effective protection of workmen against the risk is discussed.

Dechy, D.
LUTTE CONTRE LE BRUIT INDUSTRIEL GAS CONCRETS DE POTECTION DU PERSONNEL (INDUSTRIAL NOISE ABATEMENT, ACTUAL CASES OF PERSONNEL PROTECTION)
Ingenieursblad v 42 n 9, May 1, 1973, p 260-266

After a brief discussion of the inconvenience effects of noise on industrial workers, the characteristics of the most common noise sources in the industry are outlined, and a practical case of noise abatement in a workshop is considered. Finally, a review is presented of the costs of different acoustic measures. In French.

Flugrath, J. M.; Wolfe, B. N., Jr.
EFFECTIVENESS OF SELECTED EARMUFF-TYPE HEARING PROTECTORS
S/V, Sound Vibr, v 5 n 5, May 1971, p 25-27

Six earmuffs were evaluated for attenuation of narrow band noise. The acoustic attenuation was determined with the binaural, free-field, threshold shift technique. Thresholds of detectibility using the psychophysical method of adjustment were obtained at standrd octave band center frequencies. Earmuff effectiveness was found to be correlated to weight and volume of the muff and pressure of the headband. There was a range of 5 to 10 dB difference between the least effective and most effective earmuff. All of the earmuffs attenuated at least 24 dB in the higher frequencies.

Harrison, R. T.
THE EFFECTIVENESS OF MOTORCYCLE HELMETS AS HEARING PROTECTORS
Acoust Soc of Amer, New York, J, v 53 n 1, Jan 1973, p 291-392

Measurements of the at-ear noise attenuation provided by several popular motorcycle helmets were made. To do this, a probe microphone was placed in a subject's ear. He then operated a motorcycle through a test cycle, which included the motorcycle's entire performance range. He then donned a motorcycle crash helmet and repeated the test cycle. In each case the at-ear noise was recorded and analyzed. A comparison of the analyses revealed the attenuation characteristics of each helmet tested. In addition to helmet manufacturer, helmet size and type of eye protection fit were varied. Three different subjects were used to establish differences from person to person.

Jana, F. S.
APPLIED ACOUSTICAL TECHNOLOGY--BASIS OF WESTERN ELECTRIC HAWTHORNE WORKS HEARING PROTECTION PROGRAM
Amer Intl Hygiene Conf, San Francisco, Calif, May 14-19, 1972

A brief history of Western Electric's mandatory hearing conservation and engineering noise abatement program is given. To augment the in-plant long-range efforts to reduce noise at its source, the Western Electric procurement specification for the purchase of new machinery is detailed. The mandatory hearing conservation program is outlined.

Jana, F. S.
NOISE ABATEMENT ENGINEERING DESIGN FOR 90 DBA
ASME Paper n 73-IPWR-7 for Meeting May 14-20, 1973

Covers a brief history of Western Electric's mandatory hearing conservation and engineering theory on noise abatement. The current engineering noise abatement program is explained using various successful projects on reduction of noise at the source, along the path it travels, and at the receiver. In order to augment the in-plant long range efforts to reduce noise at its source, the Western Electric procurement specification for the purchase of new machinery is detailed. The Hawthorne Works hearing conservation program began on a voluntary basis in 1951. Ten years later it became mandatory. The mandatory hearing conservation program is outlined. The results of this program are also reviewed. 10 refs.

Konz, S.
NOISE AND ITS REUDCTION
Certif Eng v 45 n 1, Jan 1972
Noise: its measurement and effect on the mental and physical output of mankind. Steps which have, can and should be taken to alleviate this increasing problem are discussed. 14 refs.

Michael, P. L.
HEARING CONSERVATION
Min Congr J, v 58 n 6, June 1972

The necessary steps to be taken in the establishment of an effective hearing conservation program may involve several facets of acoustics. Basic physics of sound, noise measurement, hearing measurement and noise control procedures, that are involved in most programs, are discussed. Factors that must be considered when assessing the protection afforded by personal ear protective devices, are analyzed. Acoustical terminology is explained in an appendix. 77 refs.

Pish, R.; Sparks, C. R.
HEARING PROTECTION FOR FARM EQUIPMENT OPERATORS. THE CHALLENGE OF THE 70'S
SAE Preprint n 720718 for Meeting, Sept 11-14, 1972

The only viable approach that can assure adequate hearing protection lies in a coordinated industry effort directed toward data collection. Standards must be evolved to allow for the interchange of noise data and to provide reasonable certainty of its validity. Data must be colletected to document actual hearing losses incurred by operators of farm equipment and typical noise-exposure patterns for farm equipment operators.

Ear Damage

Davis, H.
SOME COMMENTS ON "IMPAIRMENT TO HEARING FROM EXPOSURE TO NOISE" BY K.D. KRYTER
Acoust Soc of Amer, J, v 53 n 5, May 1973, p 1237-1239

Kryter's arguments and proposals are good in principle but faulty in detail. Confusion could have been avoided by a clear separation of the concept of impairment (any change for the worse in structure or function) from handicap (a loss of efficiency in social communication). The American Academy of Ophthalmology and Otolaryngology (AAOO) rule deals with handicap, not impairment. Also its high fence recongnizes that everyday speech is not only speech at 65 dB SPL but includes some speech that is much louder. The AAOO rule was deliberately simplified to promote its use. The social adequacy index for hearing of 1948 is valid in principle but is numerically inaccurate because of poor enunciation of the recorded test material that was employed. For predicting handicap in speech communication the hearing threshold level at 2000 Hz is critical. More studies of speech discrimination in subjects who have typical noise-induced hearing loss involving this frequency are badly needed.

Cohen, A.
SOME GENERAL REACTIONS TO KRYTER'S PAPER "IMPAIRMENT TO HEARING FROM EXPOSURE TO NOISE"
Acoust Soc of Amer, J, v 53 n 5, May 1973, p 1235-1236

Reactions are offered which urge rethinking on the adequacy of a widely used criterion for defining hearing handicap in view of data referenced by Kryter, criticize evaluations basic to estimating hearing loss risk from known levels of noise exposure and recommending safe limits for hearing, and question the use of proposed complex schemes for rating noise hazards to hearing as derived from presumed relationships between temporary and permanent noise-induced threshold shifts in hearing.

Kryter, K. D.
IMPAIRMENT TO HEARING FROM EXPOSURE TO NOISE
J Acoust Soc Amer , v 53 n 5, May 1973, p 1211-1234

Research results suggest that methods commonly used in medicine for evaluation of hearing impairment and the relation of this impairment to noise exposure can lead to significant overestimates of the severity of noise-induced hearing impairment and overestimations of tolerable noise limits. Criteria are suggested for acceptable degrees of impairment for speech and a criterion of an acceptable percentage of people to suffer such impairment. Procedures are derived for calculating a speech impairment risk percent figure that represents damage effect from a variety of noise environments and can be used to specify exposure limits. The procedures are claimed to be valid for daily continuous or intermittent exposure to steady or impulsive noise. Comments by Cohen, Davis, Lempert, and Ward are answered by the author.

Kryter, K. D.
REPLY TO THE CRITIQUES OF A. COHEN, H. DAVIS, B. L. LEMPERT, AND W. D. WARD OF THE PAPER "IMPAIRMENT TO HEARING FROM EXPOSURE TO NOISE"
Acoust Soc of Amer, J, v 53 n 5, May 1973, p 1244-1252

Critiques by Cohen, Davis, Lempert, and Ward are treated individually. Questions raised by the reviewers are discussed and areas for further discussion are noted.

Ward, W. D.
COMMENTS ON "IMPAIRMENT TO HEARING FROM EXPOSURE TO NOISE" BY K. D. KRYTER
Acoust Soc of Amer, J, v 53 n 5, May 1973, p 1242-1243

The 55 dBA 8 hr basic damage risk criterion proposed by Kryter is held to be unreaslistically overconservative because it is based on erroneous assumptions and extrapolations from data. Temporary threshold shift and permanent threshold shift studies are necessary to establish credible damage risk criteria.

Industrial Noise Effects -

Forrest, M. R.; Hinchcliffe, R.; Kell, R. L.; Pearson, J. C. G.; Acton, W. I.; Taylor, W.; Atherley, G. R. C.; Noble, W. G.; Hempstock, T. I.; Chadwick, D. L.; Ward, W. D.; Nelson, D. A.
OCCUPATIONAL HEARING LOSS
Occupational Hearing Loss, Proc of Conf, Natl Phys Lab, Teddington, England, Mar 23-25, 1970, British Acoust Soc Special Volume n 1
Academic Press Inc, New York, 1971

Following is a continuation of the list of titles and authors: Ear Protection and Hearing in High-Intensity Impulsive Noise, by M. R. Forrest; Presbycusis in the Presence of Noise-Induced Hearing Loss, by R. Hinchcliffe; Social Effects of Hearing Loss Due to Weaving Noise, by R. L. Kell, J. C. G. Pearson, W. I. Acton, and W. Taylor; Clinical Picture of Occupational Hearing Loss Obtained with the Hearing Measurement Scale, by G. R. C. Atherley and W. G. Noble; Tinnitus and Noise-Induced Tinnitus, by T. I. Hempstock and G. R. C. Atherley; Occupational Hearing Loss and the Otologist, by D. L. Chadwick; On the Equal-Energy Hypothesis Relative to Damage-Risk Criteria in the Chinchilla, by W. Dixon Ward and D. A. Nelson.

Fluegge, G.
CRITICAL OBSERVATIONS CONCERNING THE EVALUATION OF EAR-DAMAGING INDUSTRIAL NOISE AT A GIVEN WORK PLACE (KRITISCHE BETRACHTUNGEN ZUR BEURTEILUNG VON ARBEITSLAERM AM ARBEITSPLATZ HINSICHTLICH HOERSCHAEDEN)
Stahl Eisen v 91 n 9, Apr 29, 1971, p 495-502

The methods of noise evaluation used in tentative VDI Guideline 2058, though based on results of national and international research, are shown to contain many contradictions: methods used by other countries, the

International Standards Organization, and the West German Hard Coal Mining Industry are discussed, mainly to stimulate further research. In German.

Lempert, B. L.
TECHNICAL ASPECTS OF DR. KRYTER"S PAPER "IMPAIRMENT TO HEARING FROM EXPOSRUE TO NOISE" WITH RESPECT TO THE NIOSH STATISTICS
Acoust Soc of Amer, J, v 52 n 5, May 1973, p 1240-1241

The National Institute for Occupational Safety and Health (NIOSH) statistics indicate that a 26 dB fence of hearing impairment for comparing hearing levels averaged at 0.5, 1, and 2 kHz versus 1, 2, and 3 kHz yields essentially equal risk values for noise-exposed populations at retirement age. On the other hand, Kryter, using a 16 dB fence for the averaging at 0.5, 1, and 2 kHz found risk values comparable to those found using a 26 dB fence for the averaging at 1, 2, and 3 kHz. The data baseline inequality between the non-noise-exposed and noise-exposed populations used by Kryter in the development of his speech impairment risk percent table raises questions as to the compatibility of his different populations. If indicated baseline corrections are used, Kryter's risk values compare favorably with NIOSH data.

Rohrer, C.
LAERMBEDINGTE GESUNDHEITSSCHAEDEN BEI KINDERM UND ERWACHSENEN
Noise 2000, Assoc Internationale Contre Le Bruit, International Congresses, 5th and 6th (London, May 1968 and Groningen, Neth, May 1970)

Reference is made to the findings of experimental medicine in recognizing early damages to man by noise. Striking parallels were revealed between the diseased behavior of noise-exposed test animals and noise-damaged children. Lehmann and Tamm have determined experimentally that in man noise causes a peripheral constriction of the blood vessels; the flow of blood from the heart to the organs diminishes. Pulse count and blood pressure are not affected. Early signs of wear and tear in the human circulatory organs are caused by states of chronic hypoxaemia, as the results of a chronic noise-specific reaction. The damages to human health caused by noise are grave. Noise, ultra- and infrasonic sound should be brought under the control of the World Health Organization.

Schulz, G.
BESONDERHEITEN DER LAERMBELASTUNG UND LAERMMINDERUNG AM ARBEITSPLATZ (SPECIAL ASPECTS OF WORK-CONNECTED NOISE DAMAGE AND NOISE ABATEMENT)
Stahl Eisen v 92 n 23, Nov 9, 1972, p 1170-1173

It is pointed out that the trend in assessing the effect of noise on working people no longer places emphasis on damage to hearing. Instead, distinctions are made between different types of noise. The effect of noise on eye sight, fatigue, etc, and the interaction of noise and other stresses (such as heat). Also, different types of activity require different methods of noise abatement (mental versus physical labor). Examples cited are taken from experience in the steel industry. 22 refs. In German.

Effects of Animals

Maiorello, R. P.; Wilpizeski, C.
TTS ACCOMPANIED BY SUSTAINED REDUCTION OF AP AMPLITUDES IN NOISE-EXPOSED GUINEA PIGS
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Guinea pigs were fitted with permanent recording macroelectrodes having tips located in the auditory nerve--cochlear-nucleus region. After recording detection levels and input-output functions for clicks or pure-tone bursts under waking conditions using computer-averaging techniques, the animals were exposed to 115 dB sound pressure level of broadband noise for 1 hr. Postnoise measurements were made within the hour following exposure and for at least four weeks thereafter. VDL's shifted for clicks and midfrequency tonal stimuli, although corresponding suprathreshold AP responses showed sustained reduction of peak-to-peak amplitudes. The altered form of the AP input-output funcitons is characteristic of nerve fiber depopulation conditions and suggests that damage occurred to the ear in spite of the fact that VDL's returned to prenoise levels.

Stebbins, W. C.; Moody, D. B.; Johnsson, L. G.; Hawkins, J. E., Jr.
HEARING IMPAIRMENT IN MONKEYS AFTER EXPOSURE TO NOISE
Acoust Soc of Amer, J, v 52 n 1, July 1972, p 112-188

Following determination of their normal hearing thresholds by operant conditioning methods, old world monkeys were exposed to octave bands of noise centered at 500, 2000, and 4000 Hz at levels between 100 and 120 dB sound pressure level (SPL) for periods of time up to 160 hr. Temporary and permanent hearing loss was evaluated daily after each exposure and for a month following the last exposure. The animals were then sacrificed for examination of the inner ear by phase contrast and scanning electro microscopy. Maximum temporary and permanent hearing loss was found at the center of the exposure band and extended as much as an octave above the center. Temporary hearing impairment of 40-50 dB occurred following an exposure level of 100 dB SPL for 2 hr. No permanent changes were observed. At the other extreme, exposures of 120 dB SPL, 8 hr daily for a month, produced temporary hearing loss of 90-100 dB at and above the octave band center, and permanent loss of 60-70 dB as measured 1 month after the last exposure. Related histophthology in the cochlea ranged from minimal to fairly extensive hair-cell loss. The size of the lesions was less than anticipated on the basis of the threshold changes. Their locations was in general agreement with the place principle.

TTS -

Chaney, R. B., Jr.; McClain, S. C.
AUDITORY TEMPORARY THRESHOLD SHIFT IN SNOWMOBILE USERS
Acoust Soc of Amer J, v 51, n 1, July 1972, p 112-188

The noise levels of many snowmobiles and other all-terrain vehicles often exceed criterion values of safe exposure as a function of time. However, there are obvious limitations to the use of CHABA criteira for determining hazardous noise exposure, since typical snowmobile use does not approximate the extent of exposure implied by the working lifetime concept. Thus, the empirical determination of the amount of temporary threshold shift (TTS) resulting from typical exposures seems to provide a more relevant approach to the question of whether snowmobile noise poses a hazard to hearing acuity of operators and passengers. TTS measurements were obtained on a number of individuals of all ages under field conditions (within 1-15 min of termination of exposure). Significant amounts of TTS were observed in a large proportion of the persons tested. The implications of the study in terms of the users, the manufacturers, and the CHABA criteria for hazardous noise exposure are discussed.

Cohen, A.; Anticaglia, J. R.; Carpenter, P. L.
TEMPORARY THRESHOLD SHIFT IN HEARING FROM EXPOSURE TO DIFFERENT NOISE SPECTRA AT EQUAL DBA LEVEL
J Acoust Soc Amer, v 51 n 2, Feb 1972, p 503-507

Experiemnts were made to determine whether measurements made on the A-weighting network of a sound-level meter could adequately depict harmfulness to hearing from exposure to noises differing widely in spectral shape. Analysis of variance of temporary threshold shifts in hearing showed insignificant differences in the range 250 to 8000 Hz. Significant interactive effects were noted between spectra and test frequencies and implications for noise ratings schemes discussed. 14 refs.

Okada, A.; Miyake, H;Yamamura, K. M.
TEMPORARY HEARING LOSS INDUCED BY NOISE AND VIBRATION
J Acoust Soc Amer, v 51 n 4 Part 2, Apr 1972, p 1240-1248

Experiments were made to determine causes of temporary hearing losses to workers exposed to both vibration and noise, such as those working with chain saws or pneumatic hammers. Temporary threshold shift was observed after exposure to vibration alone at 5 Hz. Hearing loss from broadband noise at 101 dB was found to be increased by simultaneous vibration at 5 Hz.

Mills, J. H.; Lilly, D. J.
TEMPORARY THRESHOLD SHIFTS PRODUCED BY PURE TONES AND BY NOISE IN THE ABSENCE OF AN ACOUSTIC REFLEX
J Acoust Soc Amer, v 50 n 6 Part 2, Dec 1971, p 1556-1558

Communication to the editor reports comparative experiments on the temporary threshold shift produced by a low-frequency pure tone with that produced by a low-frequency noise band in subjects with and without a measurable acoustic reflex. Differential effects in the acoustic reflex were shown to be associated with the higher temporary threshold shift produced by pure tones. In the absence of the acoustic reflex no differences in threshold shift were observed.

Medical Aspects -

Glorig, A.
MEDICAL ASPECTS OF NOISE CONTROL
TAPPI, v 55 n 5, May 1972, p 699-704

It is well known that noise produces a significant hearing loss for speech when the exposure to levels above 90 dBA is continued over several years. It has been shown that ear protection will prevent that loss but that noise control at the source is the eventual solution. This is a comprehensive representation of achievements attained in medical investigations of effect of noise on the hearing loss of a human being.

Schwetz, F.
BETRIEBSLAERMBEKAEMPFUNG IN OESTERREICH. BERICHT UEBER DIE AUDIOMETRISCHEN UNTERSUCHUNGEN BEI 50,000 LAERMARBEITERN
Noise 2000, Association Internationale Contre Le Bruit, International Congresses, 5th and 6th (London, England, May 1968 and Groningen, Netherlands, May 1970)

All Austrian hearing troubles caused by noise and measured audiometrically are classified in four groups according to their course and extent. It clearly appears that the risks of hearing troubles are necessarily of variable importance in the various enterprises. As regards the average decrease of the hearing capacity, the noise characteristic registered in every working place seems to be extremely important. All experiences gained support and facilitate the application of personal and technical audioprotective measures in the various enterprises. Moreover, the investigation of which percentage of professional diseases ought to be indemnified (relative deafness caused by excessive noise) is discussed.

Stahl, G.
BETRIEBSLAERMBEKAEMPFUNG IN OESTERREICH. BERICHT UEBER DIE ERGEBNISSE VON TECHNISCHEN LAERMMESSUNGEN IN 1,100 BETRIEBEN
Noise 2000, Association Internationale Contre le Bruit, International Congresses, 5th and 6th (London, England, May 1968, and Groningen, Netherlands, 1970)

Since 1962, the general accident insurance company of Vienna, Austria, Department for Professional Diseases and Prevention of Professional Diseases, has carried out several noise measurements and audiometric investigations in Austrian enterprises. All persons employed in working places where noise exceeded a rating value of 80 underwent an audiometric test. For approximately 5 years the test was carried out with 45,000 employees in 1,100 various enterprises. If the enterprises are classified in different gorups, the average noise level gives valuable information on the exact number of relative deafness cases due to excessive noise, which must be obligatorily indemnified.

General -

Antonova, K. P.; Rudenko, V. F.
HEALTH ASPECTS OF NOISE AT PLASTICS FACTORIES
Sov Plast n 11, 1972, p 83-85

The noise phenomena occurring in plastics machining operations are described and assessed in terms of acceptable industrial noise levels, and recommendations are put forward for combating the noise problem in Soviet plastics factories.

Barry, J. P.; Thomas, I. B.
CLINICAL STUDY TO EVALUATE ROCK MUSIC, SYMPHONIC MUSIC AND NOISE AS SOURCES OF ACOUSTIC TRAUMA
J Audio Eng Soc, v 20, n 4, May 1972, p 271-274

Results are given of a study in which ten normal hearing subjects were exposed to 60 minutes each of rock music, symphonic music, and band-limited white noise, at an average sound pressure level of 95 dB binaurally through electrostatic headphones. 12 refs.

Crocker, M. J.
APPENDIX B: THE EAR, HEARING, LOUDNESS, AND UNITS FOR RATING NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr

The construction and functions of the human ear are described, and the way the brain interprets electrical signals sent to it along the auditory nerve is considered. The subjective responses of the ear to sounds at different frequencies are examined, and units for rating noise (i.e., loudness, phons, sones, and sound level) are analyzed.

Codworth, A. L.
HEARING IMPAIRMENT FROM NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr Proc, Crocker, Malcolm J. (Ed), held in Wash, D.C.; Oct 4-6, 1972, sponsored by Inst of Noise Control Engr, Poughkeepsie, New York, 1972, p 2-4

Ears exposed to loud sounds for even short periods of time may show a significant change in their ability to hear soft sounds presented soon after exposure. If exposure is short, most of the temporary effect disappears and no permanent change is indicated. With longer, more intense exposure, a permanent change may accompany the temporary affect after a few years of daily exposure. A permanent change in hearing is first noticed at frequencies above 2000 Hz; if exposure is continued, hearing loss will spread to all frequencies associated with understanding speech. Data on the relation between impulse sound characteristics and hearing impairment are reviewed, and procedures for handling claims of loss of hearing from noise exposure are discussed.

Gerstman, H. L.; Reddy, R. E.
AUDITORY SENSITIZATION TO NOISE FROM DENTAL DRILLS
J of Auditory Res, Groton, Conn, v 10 n 1, Jan 1972, p 17-22

Auditory damage to dental operators and patients resulting from noise of high-speed (to 340,000 rpm) dental drills is examined. Paris of volunteer patients and operators, with hearing well within normal units, received pre- and postoperative Bekesy audiometry at 0.5-4 kc either with pulsed or continuous tones. Test-retest at 0.5 kc indicated reliable audiometry. Pulsed-tone testing elicited generally nonsignificant threshold shifts, but continuous-tone elicited an audiometric improvement or sensitization following dental drill exposures. Dental drill exposures were safe for patients and operators. Sensitization is an experimental artifact, possibly related to perstimulatory loudness adaptation involved in continuous-tone Bekesy audiometry during the postexposure period.

Lipscomb, D. M.
THE INCREASE IN PREVALENCE OF HIGH FREQUENCY HEARING IMPAIRMENT AMONG COLLEGE STUDENTS
Audiology, v 11, 1972, p 231-237

In 1968, at the University of Tennessee, 2,769 freshmen were given a modified screening test for hearing. The failure level was established to be 15 dB. If a student failed at any frequency, his threshold for hearing was measured for that frequency and recorded on a printed form. Failure levels were 4.6 percent, 6.8 percent, 10.5 percent, and 29.4 percent for 2000, 3000, 4000, and 6000 Hz, respectively. One year later the procedure was repeated in testing 1,410 students. The presence of hf hearing impairment rose dramatically in this group. Failure rates were 6.3 percent, 13 percent, 14.3 percent, and 54.9 percent for the 2000, 3000, 4000, and 6000 Hz signals, respectively.

Of the students tested, 7.4 percent had a hearing threshold of 40 dB for the 6000 Hz signal. The occurrence of measurable hf hearing impairment in young persons is tangible evidence of the toll being exacted by high intensity recreational and environmental sounds. Previous incidence studies and histological evidence of sensory cell damage observed in laboratory experiments are related to this finding.

Plath, P.
SIGNAL PERCEPTION IN NOISE INDUCED HEARING LOSS
Acustica, v 29 n 1, July 1973, p 47-52

Circumscribed lesion of Corti's organ, like in cases of noise induced permanent threshold shift (NIPTS), influences speech discrimination only inasmuch as the sound level for optimal speech discrimination must be increased, while a discrimination loss not compensable by speech level increment is only correlated to the age of the patients. In cases of NIPTS, the difference limen for intensity is lowered within the region of 4 kHz in comparison to normal hearing ears, especially near hearing threshold, and this lowering is not correlated to age. By these findings, the well known difficulties can be declared which arise in using hearing aids by patients with NIPTS. There are not only different hearing losses within several frequency regions, but also there is different sensitivity for sound intensity and for intensity differences. These differences can be compensated centrally by young patients; the older patients are not able to compensate the changes in the dynamics of the hearing organ.

Robinson, D. W.; Passchier-Vermeer, W.; Holmgren, G.; Johnsson, L.; Kylin, R.; Linde, O.; Burns, W.; Coles, R. R. A.; Rice, C. G.; Delany, M. E.; Stephens, S. D. G.; Surboeck, A.; Van Atta, F. A.; Bruton, D. M.; Bryan, M. E.; Tempest, W.
OCCUPATIONAL HEARING LOSS
Occupational Hearing Loss, Proc of Conf, Natl Phys Lab, Teddington, England, Mar 23-25, 1970, British Acout Soc Spec Vol, n 1, Academic Press Inc, New York, 1971

Eighteen papers were presented at the conference, dealing with the subject of hearing impairment or loss due to occupational noise. Types of noise and their environmental effect on workers, legal liability, personnel protection, presbycusis and noise control were covered. Following is a list of titles and Authors. Steady-State and Fluctuating Noise: Its Effect on the Hearing of People, by Wilhelmina Passchier-Vermeer; Noise and Hearing of a Population of Forest Workers, by G. Holmgren, L. Johnson, B. Kylin, and O. Linde; Estimating the Risk of Hearing Loss Due to Exposure to Continuous Noise, by D. W. Robinson; The Relation of Temporary to Permanent Threshold Shift in Individuals, by W. Burns; Assessment of Risk of Hearing Loss Due to Impulse Noise, by R. R. A. Coles and C. G. Rice; Some Sources of Variance in the Determination of Hearing Level, by M. E. Delany; Some Individual Factors Influencing Audiometric Performance, by S. D. G. Stephens; Hearing Conservation and

Noise Control in Industry Organized and Performed by the Accident Branch of the Austrian Social Security Board; by A. Surboeck; Hearing Conservation Through Regulation, by F. A. Van Atta; The Administration of a Hearing Conservation Programme, by D. M. Bruton; Noise Damage Liability--Evidence as to the State of Knowledge, by M. E. Bryan and W. Tempest.

Robinson, D. W.; Shipton, M. S.
TABLES FOR THE ESTIMATION OF NOISE-INDUCED HEARING LOSS
Teddington, England, Natl Phys Lab, Acoust Rep AC 61, Mar 1973

Tables are given of the essential parameters required to predict the hearing loss due to long-term exposure to noise, in terms of the statistical distribution of hearing levels in nonpathological populations. A brief description of the mathematical formulation of the tables is made and examples are given to show their use.

Rochester, S.
DETECTION AND DURATION DISCRIMINATION OF NOISE INCREMENTS
J Acoust Soc Amer, v 49 n 6, Part 2, June 1971, p 1783-1789

Experiments on the ability of the ear to discriminate between duration of various weak signals in a continuous noise background indicate that the process of aural detection and discrimination of a change in duration are similar.

Szecsody, A. J.
REVIEW OF DAMAGE RISK CONTOURS FOR OCCUPATIONAL NOSE EXPOSURE
Audio Eng Soc, Conv 45th, Preprint of Paper, New Yori, N.Y., May 15-18, 1973, n 905 (D-1), Publ by AES, N. Y., 1973

The past 22 years has seen the development of a number of damage risk contours for occupational noise exposure. Historical reliance has been made on the dB/X subscript method for establishing specifications. This paper reviews the state-of-the-art for damage risk contours and finds serious inadequacies in such a practiced methodology. Since some 57 million wage earners are now covered by the Occupational Safety and Health Act,the need for a redefined damage risk contour is documented. Especially the need to verify complex pure tones as the basic industrial noise exposure for a number of contemporqary industries. 23 refs.

General Interest

Brooks, D. B.; Berry, D. R.; Scott, N. S.; Miles, N. J.; Simon, A. O.
Vaananen, W. R.; Yuskiw, E.; Tidey, V. L.; Thompson, P. R.; Lemay, G.
Nabb, F. A.
WHAT PRICE HEALTH, SAFETY?
Can Min J, v 93 n 9, Sept 1972, 32 p (between p 26-80)

Issue contains 17 papers presented at the 41st meeting of the Mines Accident Prevention Association of Ontario (MAPAO) held in Toronto on May 17-19, 1972. Among the topics covered were: What Price Health and Safety?; Safe Operation of Load-Haul-Dump (LHD) Equipment; Noise Effect in Mining and Milling Operations; As Well As Effect of Alcohol and Drugs on Safety. The following is part 1 of the list of titles and authors. What Price Health, Safety?, by D. B. Brooks and D. Berry; Cost System Identifies People-Caused Damage, by N. S. Scott; Safe LHD Operation Requires a Close Look, by N. J. Miles and A. O. Simon; Brakes, Steering - Vital to Load-Haul-Dump System, by W. R. Vaananen; Lights Give Go-Ahead to Ramp Mining, by E. Yuskiw; Hearing Conservation Guidelines, by V. L. Tidey; Unique Noise Problem Given Practical Solution, by. P. R. Thompson, Campaign Quiets Worst Noise Offenders, by G. Lemay; Muffled Fans at Upper Canada Mines, by F. A. Nabb.

Copeland, A. B.; Mowry, H. J., III
REAL-EAR ATTENUATION CHARACTERISTICS OF SELECTED NOISE-EXCLUDING AUDIOMETRIC RECEIVER ENCLOSURES
J Acoust Soc Amer, v 49, n 6, Part 2, June 1971, p 1757-1761

A comparative statistical study was made of the attenuation data from three audiometric headsets, Aural Research 'Auraldomes' (AR-100), Madsen 'Noise-Excluding Headset' (ME-70), Rudmose (RA-125), and also a standard supraaural Headset, Telephonics TDH-39 Earphone with MX-41/AR cushion. Analysis shows that acceptability depends on octave-band noise levels as well as attenuation data. 16 refs.

Derzay, R.
HEARING CONSERVATION FOR THE MINERAL INDUSTRY
U. S. Bur Mines, Information Circ n 8564, 1972

This publication is intended to be of value to the mineral industry in establishing and maintaining effective programs for preventing noise-induced hearing loss. Factors involved in this loss and the need for and the requirements of an effective hearing conservation program are discussed. The legal and legislative history of compensation for hearing loss is briefly reviewed. A review of other aspects of the problem of industrial noise in terms of medical, physiological, and psychological frames of reference is included. A hearing conservation program is described in detail. Appendices detailing the names and addresses of a few equipment suppliers are included. References are provided for those who may wish to delve more deeply into the medical, technical, and scientific considerations of noise and its effect on man. 35 refs.

Dubrovskii, N. A. Chernyak, R. I.; Shapiro, V. M.
BINAURAL SUMMATION OF DIFFERNTLY CORRELATED NOISES
Sov Phys, Acoust, v 17 n 4, Apr-Jun 1972, p 468-473

Results are presented from psychophysical experiments in which the loudness ratio of the individual components of a complex noise image corresponding to an interaural noise correlation coefficient (R) 1; was investigated and the psychophysical functions were measured for R = 0 and R = 1. The values of R were obtained at which the loudnesses of the image of one of the independent noises and the image of correlated noise are perceived as equal. Binaural loudness summation hypotheses are discussed. 19 refs.

Eckel, A.
SELECTING AN AUDIOMETRIC ROOM
Pollut Engr, v 5 n 2, Feb 1973, p 36-37

Types of prefabricated sound rooms for use in audiometric testing to provide the proper acoustical environment so that tests can be conducted without interference from outside noise are described. Indication is given of the kind of construction that may be necessary to bring down the internal noise levels to acceptable levels for testing without interference.

DER EINFLUSS RAUMAKUSTISCHER VERHOELTNISSE IN UNTERRICHTSRAEUMEN AUF DEN LEISTUNGSERFOLG BEI SCHUELERN (INFLUENCE OF SPATIAL ACOUSTIC CONDITIONS IN LECTURE ROOMS ON THE ACHIEVEMENTS OF PUPILS)
Wiss Z Tech Univ, Dresden, v 22, n 1, 1973, p 201-209

By means of measurements of syllable comprehension, retelling of foreign language texts and mathematics tests. The negative influence of spatial acoustic conditions in lecture rooms on the achievements of pupils is objectively established. The investigation was preceded by a survey of the size, shape and construction of the available lecture rooms and by electroacoustic measurements of spatial acoustic conditions in conventional and space-acoustically treated lecture rooms. 21 refs. In German.

Marples, V.
SOME POTENTIAL APPLICATIONS OF ENGINEERING SCIENCE DISCIPLINES IN HEARING MECHANISM RESEARCH
Int J Engr Sci, v 10 n 12, Dec 1972 , p 1175-1187

The field of auditory studies available to treatment by techniques common in engineering science is described under three headings. The first is the fluid dynamic apsects of cochlea behaviour in which necessary simplification of the describing equations is achieved with the guidance of dynamic similarity experiments. The second concerns the relationship of neural excitation to basilor membrane displacement function, the terminal point for hydrodynamic analyses. Currently it is envisaged that the formulation of evaluated hypotheses of hair cell deformation will represent the most useful contribution. The third heading relates to middle ear function where an ascending series of kinematic, static and dynamic analyses will give rise to data for middle ear prosthesis redesign and novel comment on middle ear muscle function. 10 refs.

McFadden, D.; Jeffress, L. A.; Ermey, H. L.
DIFFERENCES OF INTERAURL PHASE AND LEVEL IN DETECTION AND LATERAL_ IZATION, 250 HZ
J Acoust Soc Amer, v 50 n 6, Part 2, Dec 1971, p 1484-1493

A recently published experiment by the authors with narrow-band noise centered at 500 Hz is repeated with noise centered at 500 Hz. The results are similar and indicate that sensitivity of subjects vary considerably. Data suggest that two relatively independent binaural mechanisms exist - one concerned with time differences and one with level differences.

McNeill, D.; Repp, B.
INTERNAL PROCESSES IN SPEECH PERCEPTION
J Acoust Soc Amer, v 52 n 5, May 1973, p 1320-1326

An experimental study is made of the amount of time taken by listeners to perceived aritficial stop consonants. The interval is estimated at 120 msec, while the duration of the formant transitions is only 50 msec. Speech processing thus outlasts relevant input by 70 msec, suggesting that normal speech perception can take place in the absence of input. The perceptual structure of speech would then seem due largely to autonomous internal processes rather than to the structure of the speech signal. Hypothetically, this signal serves primarily to trigger the process of speech perception.

Murray, R.
MEDICO-LEGAL ASPECTS OF NOISE IN INDUSTRY
Appl Ergonomics, v 3, n 4, Dec 1972, p 216-218

This article describes the prsent situation in the United Kingdom with respect to noise and the law. There is no specific legislation as such, but the Robens Committee on safety and health at work has recommended that in addition to a code of practice, there should be legislation and a special inspectorate to deal with noise. The question of prescribing occupational deafness as an occupational disease giving entitlement to compensation has been under consideration for some time and a decision is likely in the near future. 6 refs.

Pinheiro, M. L.; Ptacek, P. H.
REVERSALS IN THE PERCEPTION OF NOISE AND TONE PATTERNS
J Acoust Soc Amer, v 49, n 6, Part 2, June 1971, p 1778-1782

An experimental study was made of perception of auditory patterns based on an intensity difference for 20 experienced subjects for monaural and binaural conditions. The effects of white noise bursts versus 1000 Hz tone bursts on perceptual reversals of temporal sequences were analyzed. Tone burst patterns were easier to perceive. 12 refs.

Rosenstein, M.
COMPUTER GENERATED PURE TONES AND NOISE AND ITS APPLICATION TO PSYCHOACOUSTICS
J Audio Eng Soc, v 21, n 2, Mar 1973, p 121-127

Computer generation of pure tones plus filtered noise and its application to human audio detection is described. Noise may vary in pulse duration frequency rms duration, envelope, center frequency, bandwidth shape, and in bandwidths from 0.001 to 2500 Hz. Human detection is found to depend not only on intensity ratios between noise and tone but on pattern differences as well.

Teplitzky, A. M.
ECONOMICS OF NOISE CONTROL IN NEW YORK STATE
Acoust Soc of Amer, J, v 52, n 1, July 1972, p 112-188

Department of Labor Occupational Noise Exposure Standards will not protect all employees from hearing loss. For an occupational noise exposure of 90 dBA for 8 hr/d for 10 years or more, the expected New York State workmen's compensation award/employee/yr is estimated to be $25. A comprehensive hearing conservation program to reduce an employer's liability for hearing loss could be financed by savings in potential compensation awards. Similarly, in plants where the occupational noise environment exceeds OSHA noise-exposure requirements, expenditures for engineering methods for noise control may be economically justified by savings in potential compensation payments. The methodology for determining the expected employee compensation award for occupation hearing loss and its relation to potential hearing conservation program costs are reviewed.

Ward, L. M.; Suedfeld, P.
HUMAN RESPONSES TO HIGHWAY NOISE
Environ Res, v 6, n 3, Sept 1973, p 306-326

Some potential effects of the proposed extension of a major highway near a university campus were evaluated, with the expected increased levels of ambient traffic sound as the major independent variable. On self-reports, observation of the classroom behavior, and in data collected during a 5 day dormitory field experiment, increased ambient sound has adverse effects on social interaction in group problem solving, in the classroom, and on subjective reactions. No reliable changes were found on individual cognitive performance on brief tests nor in pulse rate. The need for careful, long-duration, multivariable psychological research as a part of environmental impact predictions of major construction projects is demonstrated.

Weston, R. H.; Newell, A. F.
MODELS OF NEURAL 'SHARPENING' IN THE COCHLEA
J Sound Vibr, v 15 n 3, June 8, 1971, p 443-457

Recent data, concerning the ultrastructure of the organ of Corti is reviwed. This data has been used to form two computational models of the cochlear innervation. These models are described, and their relevance to the functioning of the cochlea discussed.

White, T. G.
ERGONOMIC SURVEY OF MOBILE CRANES
Appl Ergonomics, v 4 n 2, June 1973, p 96-104

Operational tasks were studied together with interactions which affect the optimum perofrmance of the system in relation to the site organization in which they form a part. Visits to sites were made during working hours, under prevailing weather conditions, and to plant hire companies in the South Wales area. Appendices detail noise exposures in crane cabins audiological survey of crane drivers and others.

Zwicker, E.; Fastl, H.
CUBIC DIFFERENCE SOUNDS MEASURED BY THRESHOLD - AND COMPENSATION-METHOD
Acustica, v 29, n 6, Dec 1973, p 336-343

Two methods to measure the cubic difference sound produced by the nonlinearity of the ear out of two primaries have been compared quantitatively. Data collected by means of the compensation method and data collected from the same subject using the threshold method lead to almost the same results. The difference sound elicited by a narrow band noise as one of the primaries seems to be only 2 dB larger than that produced by two tones as primaries. Results of earlier papers could be confirmed and extended. 11 refs.

NOISE MEASUREMENT INSTRUMENTATION

Noise Survey Instrumentation

Industrial Noise Surveys -

Bohrer, D. A.
INSTRUMENTATION FOR "WALSH-HEALEY" NOISE SURVEYS
Forest Prod, J, v 21 n 9, Sept 1971 p 88-89

The type of equipment and training needed to comply with the Department of Labor's current occupational noise standards is shown to be relatively inexpensive and easy to obtain. Basic equipment includes a sound level meter and sound level calibrator. Noise exposure meters and impact noise analyzers may be necessary under certain circumstances to evaluate special noise areas and special noise problems.

Dunn, R. L.
INSTRUMENTS FOR CHECKING INPLANT NOISE
Plant Eng (Barrington, Ill) v 25 n 3 Feb 4, 1971 p 31-35

Sound survey meters are rapidly becoming "required equipment" in plants throughout the country. Increased awareness of the hazards of noise by federal, state and local agencies, as well as by unions and individual employees, is making frequent use of sound measuring instruments a necessity. These instruments are handy, easy to use, and relatively inexpensive. They serve their intended purpose well, but bear in mind they do not constitute the sole hardware needed for a complete noise correction program. Meters of the type discussed in this article are incapable of indicating the frequencies of the noise being measured. But they can be used to indicate whether the predominant frequencies are relatively high or low. Various types are illustrated and described.

Ebbing, C. E.; Katra, T. S.; Robertson, D. E.
IN-PLACE MACHINERY NOISE MEASUREMENTS
ASHRAE, J, v 15 n 6 Jan 1973, p 48-54

A practical method is described for measuring the sound output of mechanical equipment room machinery as it is installed and applied. Method presented for establishing noise levels can be used for proper selection of floor and wall construction materials and methods. Measurement points for a centrifugal chiller are illustrated and an example of a set of data is given. 12 Refs.

Kuehn, J. A.
MEASURING TECHNIQUES
Noise and Vibr Control for Ind Conf, (Bath, Eng, Apr 10-12, 1972)

Measuring techniques employed in noise monitoring and vibration measurement are presented. Microphones, sound level meters, sequential analyzers, parallel analyzers, level recorders, dose meters, accelerometers, velocity transducers, vibration meters, and force gauges are discussed.

Merritt, D. W.; James, R. R.
ISOGRAMS SHOW SOUND-LEVEL DISTRIBUTIONS IN INDUSTRIAL NOISE STUDIES
Sound and Vibr, v 7 n 11, Nov 1973, p 12, 14, 16-17

A procedure is presented for analysis and display of the massive blocks of noise level data normally acquired during an acoustical survey of an industrial facility. The technique consists of a special data acquisition format and computerized data processing to produce a plan-view of an industrial facility with isograms of sound levels. When used in conjunction with a plant layout print, the map identifies each noise generator and the impact it has upon the plant's noise exposure patterns.

Miasnikov, L. L.
THE CONSTRUCTIVE ANALYSIS OF NOISE
Noise and Vibr Control Engr Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

The development of constructive analysis, a method of spectral analysis that gives the typical stationary frequency amplitude representation of machinery, is described. The constructive spectrum is a sequence of segments; each segment is stationary within reasonable limits and possesses definite patterns that are retained during a specific time interval. Noise realization is represented by noise segment statistics and the constructive spectrum is a histogram of segments. The measuring device consists of an analyzer with a set of parallel band pass filters connected to a microphone or tape recorder input. The output of the analyzer forms a matrix, and a segment selector acts as a translator for an analog code input to a computer; the computer constructs the segment histogram. The use of constructive analysis in investigations on machine and air turbine noise is discussed.

Community Noise Surveys

Hamburg, J. A.
NOISE POLLUTION LEVEL INSTRUMENT
Rev Sci Instrum, v 44 n 11, Nov 1973, p 1618-1620

This article describes an instrument which has been designed and built for measuring and displaying noise pollution level directly. In additions, it displays the sound pressure level, the mean level, and the standard deviation of the level. The measurement is based on a 5 min minute interval, allowing 12 complete measurements per hour. The instrument has a dynamic range in excess of 60 dB and is automatic in operation, allowing its unattended use for long periods of time with a chart or digital recorder. 5 refs.

Kamperman, G. W.
TECHNIQUES FOR SAMPLING ENVIRONMENTAL NOISE
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1971)

The most common method for evaluating the fluctuating character of environmental noise is to determine the decible A weighted sound levels that are exceeded 1, 10, 50, and 90 percent of the time. A sound level meter is used with this technique, and fluctuations of outdoor environmental noise are averaged; however, this procedure often leads to gross errors. A more accurate method for determining the cumulative distribution over a one hour period using a two minute sample is to divide the two minute sample into many microsamples evenly distributed over the hour. Tests validating the microsample method are discussed, and the development of a microsampling recorder is described.

Kamperman, G. W.
WAYS TO WEIGHT NOISE OUTDOORS
Noise Control Engr, v 1 n 1, Summer 1973, p 40-45

As noise surveys become more of a factor in assessing the nature and extent of community noise problems, one needs to provide a better form of statistical description of noise exposure with good correlation to the real source of annoyance. This is especially necessary when the noise level varies in an unpredictable manner. Analog recorded microsampling of the noise environment can provide identification of the noise source and spectrum content together with detailed statistical information for any time period covered by the recording. This technique is described. It is a significant step along the path to simplified measurement of fluctuating environmental noise levels. The first step toward such simplification was the use of the A-weighted level instead of 9-octave bands. The A-weighted level is a useful descriptor for most noise sources and is readily available on all sound level meters.

Siddon, T. E.; Harford, K. D.
LOW COST APPROACH TO AREA-WIDE NOISE MONITORING
Acoust Soc of Amer, J, v 54 n 3, Sept 1973, p 646-649

The current approach to noise survey work emphasizes the importance of spatial and temporal noise level variations, with less stress on frequency content. A simple clock-switched sound monitoring package, A-weighted at the input stage, and with dynamic range of 45 dB, yields adequate information on which to base a concise, statistical model of the acoustic landscape. Because of the low-cost nature of individual terminal units, a large number of units may be operated simultaneously over an extended area. This ensures that important spatial information is not lost. Such a detailed picture is not possible with the more conventional sequential (point to point) techniques which are normally employed.

Schultz, T. J.
SOME SOURCES OF ERROR IN COMMUNITY NOISE MEASUREMENT
Sound and Vibr, v 5 n 2, Dec 1971, p 18-27

Nois measurement: community noise simplified methods. Short-cut methods for measuring community noise levels are proposed, including: using only an A-weighted sound level; reducing observation time periods; and using measurement equipment that is less complicated than statistical analysis gear. Some of the errors that may result from simplified methods are considered.

Sound Power Instrumentation -

Anon
SOUND POWER MEASUREMENT SYMPOSIUM
Acoust Soc of Amer, J, v 54 n 4, Oct 1973, p 930-984

The papers deal with two broad categories of sound power measurements. Material presented at an earlier symposium on reverberation room measurements was updated and extended. Some of the problems of in situ measurements are addressed. Among these are situations in which precision measurements in a reverberation room are not practical, either because facilities are unavailable for operating the equipment or because it is not practical to move the equipment to a reverberation room. There is a need for description of techniques for noise measurements on machines as installed. While these measurements may be less precise than those made in a controlled acoustical environment, they provide data that are satisfactory for many noise control purposes.

Graham, J. B.
HOW TO ESTIMATE FAN NOISE
Sound and Vibr v 6 n 5, May 1972, p 24-27

A method of fan noise estimation is described. Specific sound power levels of all common fan types are tabulated, and simple equation involving only fan delivery volume and pressure is used to correct specific ratings to actual sound power levels generated.

Lubman, D.
SPATIAL AVERAGING IN SOUND POWER MEASUREMENTS
J Sound Vibr, v 16 n 1, May 8, 1971, p 43-58

Nomographs and formulas are presented from which an experimenter may determine the confiednce level of their estimate in terms of signal bandwidth reververation time, and number of fixed microphones or the path length for a moving microphone. Finally, the remarkable performance of rotating diffusers is described in terms of their improvement in the statistical accuracy of the measured mean. 16 refs.

Tichy, K.
THE MEASUREMENT OF SOUND POWER IN A REVERBERATION CHAMBER AT DISCRETE FREQUENCIES
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1971)

A method of sound power measurement in which a noise source is placed into a reverberation chamber with highly reflective walls is described. At large enough distances from the source, the reflected sound wave creates a reverberant sound field; the total radiated sound power is proportional to the square of the sound pressure measured in the reverberant field. The major advantage of this method is that it eliminates the need for considering the directivity pattern of the source. However, accuracy is limited by the modal character of the chamber, measured frequency range, source position, etc. In addition, the sound power radiated from a sound source in a reverberation chamber differs from that radiated in an unbounded medium. The major factor affecting accuracy is the sound spectrum radiated by the source. The sound power of sources with continuous and broadband spectra can be measured more accurately than the sound power of sources of discrete frequencies or narrow band spectra.

Sound Pressure Instrumentation -

Nakamura, A.; Sugiyama, A.; Tanaka, T.; Matsumoto, R.
EXPERIMENTAL INVESTIGATION FOR DETECTION OF SOUND-PRESSURE LEVEL BY A MICROPHONE IN AN AIRSTREAM
J Acoust Soc Amer, v 50 n 1 pt 1, July 1971, p 40-46

A new concept is derived for characterizing microphone response to windflow fluctuation. An experimental study is made of the response of a microphone when the sound pressure and turbulence-fluctuated pressure impinge simultaneously on its diaphragm. The arrangement provides a lower limit of sound pressure level that can be detected by the microphone.

Dosimeter -

Basch, M. W.
A WEARABLE POCKET NOISE DOSIMETER
Acoust Soc of Amer, New York, J v 52 n 1, July 1972, p 112-188

A noise dosimeter that meets the ANSI type II sound-level meter standard and accumulates the Walsh-Healey percentage is discussed. The dosimeter is composed of two parts: a small pocket unit that accumulates and stores the digital data representing the Walsh-Healey percentage, and an indicator unit that provides a digital readout on a light emitting diode display. The indicator unit also provides for calibrating the pocket unit, including the microphone, and for checking batteries. Newest technology has permitted the pocket unit to be made very small and light. It includes a small ceramic microphone, a true RMS detector with more than 15 dB crest factor capacity, and an extremely low-power mos digital counter to store the Walsh-Healey percentage. It weighs 7 oz and runs for over 300 hours on an ordinary 9V transistor battery. Frequency response measurements will show the effect of the proximity of the wearer.

Brueel, P. V.
NOISE MEASUREMENT TECHNIQUE
Ind Waste Management, Symp, (Sheridan Park, Ontario, Canada, Nov 3-4, 1971)

Noise measurement techniques are discussed in three sections: noise surveying and monitoring in terms of dBA, equivalent continuous sound levels, and noise doses; sophisticated measurement and evaluation systems such as the computerized techniques used in on-line determination of sound power, and measurement and evaluation of sonic booms. A new method for measuring noise, the nose dose meter, is described.

Conn, D. O.
AUDIO DOSIMETER - A SYSTEM FOR MEASURING PERSONAL NOISE EXPOSURE
V, Sound Vibr, v 6 n 9, Sept 1972, p 8, 10, 12, 14

Incorporation of the Walsh-Healey hearing conservation criteria into the 1970 Occupational Safety & Health Act (OSHA) now requires industry to adopt those standards which have proven effective in preventing occupational hearing loss. In order to economically and effectively comply with the OSHA standards, it is necessary to calculate an individual's exposure level for work environments that have noise levels of 90 dBA or higher. A personal noise monitor is described which cumulatively registers in percent the OSHA exposure in an electrolytic memory cell. At the end of the work shift, the dosimeter is taken from the employee and the cell is removed. The cell is read in a separate readout instrument. The principles of the memory cell are explained and a flow diagram of the readout device is presented. 4 refs.

Raymond, R. W.
NEW NOISE EXPOSURE METER
S/V, Sound Vibr, v 5 n 5, May 1971 p 6, 8, 10

Description of type 1934 Walsh-Healy noise exposure meter. This simple instrument does all of the measuring, averaging, accumulation, calculation, and even impact detection automatically, then stops. An operator is required only to start measurements in the morning and record total readings at day's end. A strip chart recorder can be used with the instrument to record occurrence time of high exposure levels. A digital output is provided, thus enabling one to use the meter with a printer to record the elapsed time percentage and the Walsh-Healey noise-exposure percentage.

Loudness Measurements -

Bernstein, R.
SOUND AND NOISE LEVEL MEASUREMENTS
IEEE Trans Broadcast Telev Receivers, v BTR-19 n 2, May 1973, p 106-112

In television receivers the horizontal scan system gives sound level radiations at a frequency of 15.734 kHz for color and 15.750 kHz for black and white. Since this is an unwanted sound transmission, it is classified as noise even though it is not stochastic in nature. The investigation in this paper is directed towards measuring and studying this undesired sound by acoustical methods.

Bauer, B. B.; Torick, E. L.; Allen, R. G.
MEASUREMENT OF LOUDNESS LEVEL
J Acoust Soc Amer, v 50 n 2 pt 1, Aug 1971, p 405-420

A survey is made of present and potential instrumentation to measure loudness level of sounds. The history of the sound-level meter is discussed. A loudness level monitor is described for directly measuring the relative loudness level of broadcast programs. A new set of equal-loudness contours is shown and a new law discovered for loudness-level addition for combined bands of noise. Psychoacoustical evaluations are given for loudness level meter vs sound-level meter.

Olson, H. F.
MEASUREMENT OF LOUDNESS
Audio, v 56 n 2, Feb 1972, p 18-22

A loudness meter has been described which indicates the loudness of an audio signal. Since the ultimate significant subjective destination of all original or reproduced sound is the human ear, a meter which indicates the loudness as perceived by the ear is an important audio instrument. For example, the loudness meter will become a very useful tool for determining the loudness of any simple or complex sound or noise, for monitoring the maximum permissible level of all manner of audio programs, for obtaining the maximum loudness of an audio program for a certain maximum peak level, etc. Topics discussed include the loudness scale, measurement of loudness, and the performance of the loudness meter.

Starr, E. A.
MEASURING NOISE POLLUTION
IEEE Spectrum, v 9 n 6, Jun 1972, p 18-25

An important part of any successful measurement is the selection of the quantities to be measured - and in the case of noise pollution measurements this selection is particularly troublesome. Sound pressure levels are only a part of the story and can be deceiving. For example, enjoyable sounds can be louder than annoying ones. The fundamental problem is that the quantities to be measured must includes man's reaction to the sound - a reaction that may be determined by such varied factors as the time of day, his physical comfort or discomfort, characteristics of the sound, and attitude toward the person or device generating the sound. It is impossible to include all of these parameters in one simple measurement. The best that one can do is to gain an understanding of man's response to sound in order to develop ratings for quantifying noise pollution. Some psychoacoustic experiments in this direction, examples of ratings, and typical acoustic instruments used in the field are discussed. These include various scientific and regulatory (legislated) criteria, the standard characteristics of octave and third octave acoustic-wave filters, and arrangements and equipment for monitoring aircraft noise around airports. 34 refs.

Diagnostic Sound Measurement -

Baade, P. K.
IDENTIFICATION OF NOISE SOURCES
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap (Wash, D. C., Oct 4-6, 1972)

Procedures for identifying noise at its source are suggested diagnostic sound testing and sound source identification tests must be accomplished, along with source modification and recognition, localization of the origin of sound radiation, and analysis of sound signals. The use of frequency analysis for identifying noise generated by a 1,900 HP drive in a large cement mill is described, and time domain analysis of punch press noise is characterized. Instrumentation for diagnostic sound testing is also considered.

Bell, L. H.; Raymond, A. J.
SOLVING THE NOISE PROBLEM
SPE J, v 28 n 1, Jan 1972, p 16-19

The fundamental physics of sound, and the instruments used to measure and characterize it, are explained with a view to assessing the character and magnitude of noise sources in a typical molding room. Measures that have successfully reduced noise from grinders, vacuum loaders and other kinds of molding equipment are described, and methods of organizing noise control programs are discussed from the point of view of both manufacturer and user.

Beran, D. W.
ACOUSTICS. A NEW APPROACH FOR MONITORING THE ENVIRONMENT NEAR AIRPORTS
J Aircraft, v 8 n 11, Nov 1971, p 934-936

This note describes an acoustic echo sounder capable of detecting wake vortices as well as other important meteorological parameters. The strong interaction of acoustic waves with the atmosphere can be used to sense a variety of details about the structure and motions within the boundary layer. 11 refs.

Bhattacharya, M. C.: Guy, R. W.
INFLUENCE OF THE MEASURING FACILITY ON THE MEASURED SOUND INSULATING PROPERTY OF A PANEL
Acustica, v 26 n 6, Jun 1972, p 344-348

A discussion is presented of the discrepancies found when comparing reverberant room transmission loss measurements using differing test facilities. The authors suggest the finiteness of both test facility and panel as contributing to the differences in presented results. Theoretical analysis and measurements made by several workers are also discussed. 6 refs.

Brown, D. L.; Halvorsen, W. G.
APPLICATION OF THE COHERENCE FUNCTION TO ACOUSTIC NOISE MEASUREMENTS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

The feasibility of using the coherence function technique to locate sources of noise is discussed, and the possibility of computing frequency spectra and SPL's associated with noise sources in the presence of other incoherent sources is demonstrated. The technique is very useful for noise surveys and noise control measurements, but is must be carefully applied in order to avoid errors. Some of the problems encountered with this technique include time lag between the microphone and source transducer signals and numerical errors due to the limited dynamic range of analysis instrumentation.

Buss, S.
NOISE MEASUREMENT. PRINCIPLES AND DEVICES (Schallmesstechnik. Grundlagen und Geraete)
Elektrotech Z Ausg B, v 23 n 20, Oct 1, 1971, p 478-480

Noise measurement is reviewed on the background of more stringent requirements of environmental protection. The possibilities of solving part of the problems by measurements are discussed and the types of instruments available reviewed. In German.

Crocker, M. J.
APPENDIX A: USE OF ANECHOIC AND REVERBERANT ROOMS FOR MEASUREMENT OF NOISE FROM MACHINES
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap (Wash, D. C., Oct 4-6, 1972)

Methods for measuring noise emitted from machines is described, with emphasis on reverberant and anechoic rooms. Procedures for calculating mean sound level, mean band and SPL, sound power level, and directivity index are also considered. Machine sound power measurement is achieved more rapidly in a reverberant room than in a free field or an anechoic room because fewer measurements are needed. However, information on noise source directivity is lost in a reverberant room.

Gibbs, B. M., Jones, D. K.
SIMPLE IMAGE METHOD FOR CALCULATING THE DISTRIBUTION OF SOUND PRESSURE LEVELS WITHIN AN ENCLOSURE
Acustica, v 26 n 1, Jan 1972, p 24-32

By use of a computer, a simple image method is used to predict variation in sound pressure level throughout a rectangular room possessing various absorption configurations. A model room was constructed and it is shown that the computer prediction correlates better with measured values than does the classical prediction which assumes a diffuse sound field.
13 refs.

Moore, C. J.
SOLUTION TO THE PROBLEM OF MEASURING THE SOUND FIELD OF A SOURCE IN THE PRESENCE OF GROUND SURFACE
J Sound Vibr, v 16 n 2, May 22, 1971, p 269-282

The solution to the ground reflection problem which is described in this paper is to treat an area of the reflecting surface at the geometric reflection point with a sound absorbing treatment. This treatment has been shown to reduce the effect of interference on the far field of a pure-tone source to plus or minus 1.5 dB and to considerably improve the accuracy of the measurement of the free acoustic field of a research fan.
17 refs.

Oncley, P. B.
CORRECTION PROCEDURE FOR OUTDOOR NOISE MEASUREMENTS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

The ways in which atmospheric absorption and refraction and ground reflection affect aircraft noise measurements are described. Various techniques for correcting aircraft noise measurements are described, including obtaining supplementary data, changing the position of the measuring equipment, and using mathematical formulas.

Pierce, A. D.
NOISE DIFFRACTION: SUGGESTED ESTIMATION PROCEDURES
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D.C., Oct 4-6, 1972)

Formulas, curves, and procedures for estimating SPLs at locations partially shielded from a sound source by a barrier are outlined. Computational procedures are restricted to the case of a listener in a shadow zone. In a shadow zone, SPLs are generally less than those that would be expected if a barrier were not present. Excess attenuation in single and double edge diffraction is described.

Porter, M. S. Delap, J. Q.
DISCRETE SOURCE IDENTIFICATION IN THE PRESENCE OF HIGH AMBIENT NOISE LEVELS
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D.C., Oct 4-6, 1972)

A method for isolating individual noise sources in large internal-combustion engines from each other was developed in order to identify the contribution of each component noise source. An isolator device consisting of a tube of dense plastic material lined with a PB/foam sandwich was used, and a survey meter was mounted at the closed end of the tube. The application of real time analysis to this technique reduced measurement and analysis times.

Quindry, T. L.; Flynn, D. R.
SIMPLIFIED FIELD MEASUREMENT OF NOISE REDUCTION BETWEEN SPACES
Acoust Soc of Amer, New York, J, v 53 n 1, Jan 1973, p 291-392

The present American Society for Testing and Materials procedure for field measurement of the noise reduction between spaces is time consuming and costly because it requires numerous measurements in order to compute the noise isolation class (NIC), particularly when separate measurements must be made at multiple microphone positions to obtain adequate spatial averaging. The relationships between NIC values based on 1/3 octave band data and more easily obtained ratings of isolation based on either octave band data or on A-weighted or C-weighted sound level data are explored. A large number of curves of 1/3-octave band noise reduction vs frequency were calculated from data on transmission loss of partitions, assumed room geometry, assumed values for the source sound power spectrum, and assumed values for the sound absorption in the source and receive rooms. For each of these 1/3-octave band noise reduction curves, the follwong quantities were calculated and compared: NIC rating, 1„ rating, 1„ rating (1/3-octave band data), 1„ rating (octave band data), the A-weighted sound lev el difference, and the difference between the C-weighted level in the source room and the A-weighted level in the receive room.

Schneider, A. J.
INSTRUMENTS FOR ANALYZING AND EVALUATING AUTOMOTIVE NOISE
Automotive Engr, v 82 n 3, Mar 1974, p 98

A wide variety of frequency analysis instrumentation is available for sound and vibration analysis. But unless the optimum instruments are chosen for each task, the engineer will be bewildered by either insufficient or excessive data. Instrument usages that have been standardized in the automotive industry are outlined.

Scholes, W. E.; Salvidge, A. C.
STATISTICAL ANALYSIS FROM A SOUND LEVEL METER
Appl Acoust, v 6 n 2, Apr 1973, p 111-117

Increasingly, and particularly for motorway noise, sound level meters are being used to estimate L_{10}, the noise level just exceeded for 10 percent of the time, by noting the meter readings at regular intervals and manually analyzing the array of data so obtained. A simple attachment on a sound level meter to ease the operator's task in making such measurements and to minimize operator bias is described. Comparisons are made between sound level meter measurements of three types of noise and measurements of a more conventional technique, which employs a level recorder and statistical analyzer. For motorway noise, the sound level meter technique gives values of L_{10} and L_{90} within 1dBA of the values obtained by the normal method. The technique will probably be useful in measuring other types of noise.

Steinbach, R. D.,; Marsh, E. G.
EXPERIMENTAL DAMPING MEASUREMENT TECHNIQUES AND RESULTS BOTH IN AIR AND WATER
Inst of Environmental Sci Annu Tech Meet, 19th, Proc, (Anaheim, Calif, Apr 2-5, 1973, available from Inst of Environmental Sci, Mt Prospect, Ill, 1973) p 307-312

The addition of damping materials to the self-noise generated by vibration has been done for years at great expense to the Navy. In this study, several measurement techniques and the various drawbacks and errors of each method are considered. It is shown that the increase in the damping effectiveness or damping coefficient was much less in water than in air. The test technique allows measurements on normal structures to determine just how much vibration attenuation is obtained.
4 refs.

Sugiyama, A.; Tanaka, T.; Nakamura, A.
DETECTION OF NOISE LEVEL GENERATED BY A GRILLE IN AN AIRFLOW
J Acoust Soc Amer, v 51 n 6 pt 1, Jun 1972, p 1794-1801

Measurements were made with a streamlined probe microphone to evaluate pressure level of sound generated by a grille in an airflow. Distributions in a flow duct of the turbulence-fluctuated pressure of the airflow and of the output level of the microphone were measured and compared with transmission properties specified for the duct.

Noise Rating Methods -

Barducci, I.; Borruso, P.; Ibba, G.
PROBLEMS CONCERNING NOISE RATING METHODS
Noise 2000, Assoc Intl Contre le Bruit, Intl Congresses, 5th and 6th, Zonderland, P. (ed), (London, Eng, May 1968 and Groningen, Neth, May 1970) p 205-207

An analysis of the noise rating methods shows that the acceptable limiting values still lack some of the most elaborated noise indexes which could give reliable information in an extended field of application. Procedures recommended by international organizations include the sound levels A, B, C measured with a sound level meter; the loudness level, determined according to Steven's method: the loudness level, determined according to Zwicker's method; and the perceived noise level, determined by Kryter's method. Some suggestions are presented in order to remove, at least partially, the mentioned inconveniences.

Barton, C. K.
A SINGLE NUMBER RATING FOR EFFECTIVE NOISE REDUCTION
Sound and Vibr, v 7 n 2, Feb 1973, p 23-25

In airborne-noise control, there is a trend toward the use of single number ratings for airborne-noise levels. A method for calculating a single-number rating for the effectiveness of a noise attenuating device is presented. A short computer program makes the necessary calculations, and a typical study was conducted to illustrate its use.

Instruments -

Laser Analysis -

Fetterman, C. C.
LASER ANALYSIS OF ENVIRONMENTAL NOISE
IEEE Trans Audio Electroacoust, v AU-21 n 2, Apr 1973, p 118-120

Environmental noise induces frequency instabilities in lasers. By analyzing these instabilities, we can determine the characteristics of the noise and thus identify the source, using the laser, in effect, as a supersensitive "microphone." The techniques described can be used for supersensitive detection and identification of extremely low-level noise sources.

Shock Tube and Space Average Measurements -

Kamperman, G. W.
INSTRUMENTATION FOR NOISE MEASUREMENT
Inter-Noise 72, Intl Conf on Noise Control Engr, Tutorial Pap (Wash, D. C., Oct 4-6, 1972)

Microphones and vibration pickups used to measure noise are described, including ceramic, condenser and electret microphones and accelerometers. Calibration of these systems is discussed, and the use of sound level meters for signal amplification is considered. Tape recorders and signal analyzers that can be incorporated into noise measurement systems are also examined.

Rasmussen, G.
MEASUREMENT MICROPHONES
Inter-Noise 72, Intl Conf on Noise Control Engr, Proc, (Wash, D. C., Oct 4-6, 1972)

Frequency responses of free-field and pressure microphones are analyzed, and improvements in microphone technology are discussed. Noise measurement microphones must be able to respond to pressure variations. Piezoelectric microphones do not offer the well defined geometry, wide frequency range, and correct damped resonance that condenser microphones do. Electrets using Teflon or F.E.P. foils are being used in low cost microphones, but they are not as good as stretched metal diaphragms. A method which protects condenser microphones from moisture and reduces noise in humid conditions is described.

Mariano, S.
SHOCK TUBE TECHNIQUE FOR TESTING ACOUSTIC MATERIALS
AT VERY HIGH SOUND AMPLITUDES
J Sound Vibr, v 14 n 2, Jan 22, 1971, p 145-150

A new technique to test acoustic materials at very high sound levels is presented. This technique is based on the use of a shock tube, and was applied to acoustic samples having a facing made of perforated plates of different open area ratios. Results of the absorption coefficient at resonance for several values of the open area ratio are presented. 7 refs.

Wooten, E. J.; Cary, H.
INSTRUMENTATION FOR SPACE AVERAGED ACOUSTIC MEASUREMENTS
Noise and Vibr Control Engr Conf, Proc, (Lafayette, Ind, July 14-16, 1971)

A six channel multiplexer has been developed to test the validity of a concept of using many microphones randomly positioned in a reverberant chamber to obtain a single workable waveform where phase differences from point to point do not affect the energy contained in a waveform. The effects of scanning speeds, RMS detection time constants, and the measurement of reverberant decay are investigated. Space-averaged sound pressure measurements are valid using sequentially sampled arrays of microphones, provided: the scanning rate (in channels per second) is slower than one-twentieth of the center frequency of the lowest 1/3-octave filter (.05 FC) and the true-RMS detection time constant is longer than the period of a complete scan of all channels.

Wedge Design -

Koidan, W.; Hruska, G. R.; Pickett, M. A.
WEDGE DESIGN FOR NATIONAL BUREAU OF STANDARDS ANECHOIC CHAMBER
J Acoust Soc Amer, v 52 n 4 pt 1, Oct 1972, p 1071-1076

A relatively new glass wool material was adapted for wedge design having a cutoff frequency of 50 Hz for an anechoic room at the U. S. National Bureau of Standards. The wedge consists of glass wool of two densities, three lb/cu ft for the 55 in. tapered portion and 1.1 lb/cu ft for the 11 in. base. Details are given of impedance measurements for propagation into the wedge from the tip.

Impulsive Sound Measurement -

Kundert, W. R.
IMPULSE SOUND-LEVEL METER - WHAT'S IT ALL ABOUT?
SV Sound Vibr, v 8 n 3, Mar 1974, p 50-53

The detection characteristics of a new impulse precision sound-level meter are compared to the "ordinary" precision sound-level meter. It is shown that the new instrument is suitable for measuring in accordance with the CHARA criterion for impulse noise. 7 refs.

Schneider, A. J.
OMNIDIRECTIONAL HIGH-FREQUENCY SOUND LEVEL METERS
Amer Ind Hygiene Assoc, Baltimore, J, v 33 n 3, Mar 1972, p 165-169

Measurement of community and factory noises calls for microphones that are omnidirectional. High frequency response is also essential because A-weighted measurements, used in this work, emphasize frequencies from 500 Hz to 10 kHz. Present standards for sound level meters guarantee neither omnidirectionality nor high frequency response. Accurate measures of noise environments depend on the proper choice of microphones and adaptors, and sound level meters that meet the International IEC 179 precision sound level meter standard should be used.

Weinberger, A.
PORTABLE IMPULSE SOUND-LEVEL METER EGT
News, Rohde & Schwarz, v 11 n 47, 1971, p 5-9

A meter is described which is suitable for all standard acoustic tests between 20 and 160 dB, and also for acceleration and AC voltage measurements. The instrument meets the requirements of the German DIN 45633 as well as of IEC 179 with regard to precision and impulse standards. In addition to AC and DC outputs it also prossesses a filter-connection facility. The frequency response can be switch-selected to be either linear, conform to the standard weighting curves A, B, C, D, or that of an external filter; a meter-response switch allows the selection of a fast, slow or impulse response mode.

General -

Belousov, N. N.; Kirsanov, N. I.
DISCRIMINATOR OF A TRACKING INSTRUMENT FOR MEASURING THE SPATIAL DELAY TIME OF A NOISE-LIKE SIGNAL
Telecommon Radio Engr, v 26-27 n 3, Mar 1972, p 108-115

The discriminator of a tracking instrument for measuring the spatial delay time of a noise-like signal is investigated. The discrimination and fluctuation characteristics are determined for normal stationary additive signals and noise in the case of rapid fluctuations. 4 refs.

Crocker, M. J.
NOISE SOURCES, NOISE MEASUREMENTS AND NOISE REDUCTION
Amer Soc of Agricultural Engr, Pap 72-812, 1972

The propagation of sound energy is discussed, including spherical spreading, plane waves, reflection, and diffraction. Sound pressure levels and decibels are defined. Instrumentation for noise measurement and the use of the instrumentation in the measurement of sound-pressure and sound-power levels are reviewed. Measurements with machines in situ and in ideal anechoic and reverberant rooms are considered. The basic techniques commonly used to reduce noise are reviewed: vibration isolation, enclosure absorption, and damping.

Fearn, R. W.
REVERBERATION TIME
Heat Vent Engr, J Air Cond, v 46 n 540, July 1972, p 3-6

The principle behind reverberation measurement described is the calculation of the rate of delay of a sound burst within a room. The usual sources of sound are beat frequency oscillators with a warble tone to prevent standing waves, or random or white noise generators. Tests were taken with several different types of noise source. Best results were obtained with the bursting balloons.

Kolesnikov, A.
DETERMINATION OF THE SENSITIVITY OF SOUND RECEIVERS
Meas Tech, v 14 n 8, Aug 1971, p 1251-1254

How by using the equivalent circuit of a piezoelectric transducer it is possible to express its sensitivity in the range or reception defined by the rate of the transducer potential to the acoustic pressure generated by it through the resistance of the radiator and the characteristics of the medium.

Mende, H. G.
LAERMPEGELMESSUNGEN IN DER ALLTAGSPRAXIS (DAILY ROUTINE MEASUREMENTS OF NOISE LEVELS)
VDI Z, v 115 n 14, Oct 1973, p 1126-1131

A survey of the newest noise level recording equipment is given. The aspects of accurate measurements are discussed and recommendations are made, based on experimental results, for various noise sources and environments. 5 refs. In German.

Nelson, P. M.
THE COMBINATION OF NOISE FROM SEPARATE TIME VARYING SOURCES
Appl Acoust, v 6 n 1, Jan 1973, p 1-21

Two methods of combining time-varying noise sources are proposed, and the applications of these procedures to practical situations are discussed. One method enables L_{10} (the noise level exceeded for 10 percent of the time) and L_{90} values to be determined when two or more Gaussian traffic noise distributions are combined. The combination technique may be applied to various noise sources; e.g., the interaction of aircraft fly-past and surface traffic noise.

Nitsche, J. R.
A SURVEY OF SPECTRAL ANALYSIS TECHNIQUES PERTINENT TO THE STUDY OF MOVING SOUND SOURCES
Acoust Soc of Amer, New York, J, v 52 n 1, July 1972, p 112-188

Several spectral analysis techniques which are pertinent to the study of the radiated noise associated with moving sound sources are described. Applications of the minicomputer HRC-1360. Acoustical analysis system are discussed; one-third octave band, narrowband, and several variations thereof are included. Algorithms for correlation, coherence, and probability density analysis can also be implemented depending upon the particular requirements of the investigation.

Schneider, A. J.
SOUND APPROACH TO ACOUSTIC NOISE MEASUREMENT
Electron Prod, v 16 n 8, Jan 21, 1974, p 133-140, 143

Sound measuring instruments and especially sound level meters are described. Noise measurements are discussed with emphasis on the requirements of the Occupational Safety and Health Act.

Schultz, T. J.
SOUND POWER MEASUREMENTS IN A REVERBERANT ROOM
J Sound Vibr, v 16 n 1, May 8, 1971, p 119-129

The ASHRAE standard test procedure for measuring the sound power output of mechanical equipment in reverberation room is discussed. Particular attention is given to the qualification test required of a facility for the measurement of pure tones.

Slusser, R. A.
CLOSED-LOOP AUTOMATIC CONTROL SYSTEM FOR HIGH-INTENSITY ACOUSTIC TEST SYSTEMS
J Environ Sci, v 16, n 3, May-Jun 1973, p 9-13

The current automatic control system used at the Jet Propulsion Laboratory works in one-third octave bands, the desired levels are set into the memory in the control system before the test. The control system then increases the sound pressure level in the reverberation chamber gradually in each of the one-third octave bands until the level set in the memory is reached.

Veit, R. W.
A PORTABLE TAPE RECORDER FOR NOISE ANALYSIS
Amer Ind Hygiene Assoc, J, v 32 n 9, Sept 1971, p 579-582

A light-weight battery-powered tape recorder has successfully been adapted for noise analysis in the frequency range of 20 to 10,000 Hz. Minor circuit changes were necessary to obtain the desired flat response. The recorder, complete with rechargable nickel-cadmium batteries and leather case, weighs 8.5 lb, and 10 sec recording provides adequate tape for the laboratory octave band analysis.

Weissing, H.; Banda, S.
EIN GERAET ZUR DIREKTEN MESSUNG DES AEQUIVALENTEN DAUERSCHALLPEGELS (INSTRUMENT FOR THE DIRECT MEASUREMENT OF THE EQUIVALENT LEVEL OF CONTINUOUS SOUND)
Z Elektr Inf Energietech, v 3 n 1, 1973, p 22-30

Operation and implementation are presented of an instrument in which the long-time integration, which is necessary for obtaining measurement data, is realized through voltage-frequency conversion followed by pulse counting. After the count passes a logarithmic processor, the desired result is obtained directly. The achieved simplification is of importance for the measurement of (acoustic) noise. 15 refs. In German.

Standards -

Anon
A COMPILATION OF STANDARDS FOR NOISE RATINGS AND MEASUREMENTS
Sound and Vibr, Cleveland, v 6 n 10, Oct 1972, p 18-21

Standards related to noise ratings, noise measurements, and noise tests are listed by complete title under the name of the organization issuing the standards. Addresses are listed, and complete standards can be purchased from the organizations.

Anon
AMERICAN NATIONAL STANDARD SPECIFICATION FOR SOUND LEVEL METERS
ASME, Amer Natl Stan ANSI S 1.4, 1971

The purpose of this standard for sound level meters and their calibration is to ensure maximum practical accuracy in any particular sound level meter, and to reduce to the lowest practical minimum any difference in corresponding readings with various makes and models of meters that meet the standard. This standard provides the minimum requirements for three basic types of sound level meters: types one, two, and three, with performance requirements that become progressively less stringent, proceeding from type one to type three. Provision is made for a special purpose sound level meter, type S. If a sound level meter that meets this standard is modified, it must be demonstrated that the modified sound level meter meets this standard.

Anon
METHODS FOR THE DETERMINATION OF SOUND POWER LEVELS OF SMALL SOURCES IN REVERBERATION ROOMS
ANSI Stand S1.21, 1972

This standard describes in detail two laboratory methods for determining the sound power radiated by a device, machine, component, or subassembly as a function of frequency using a reverberant test room having prescribed acoustical characteristics. While other methods could be used to measure the noise emitted by machinery and equipment, the methods described in this standard are particularly advantageous for rating the sound output of sources which produce steady noise and for which directivity information is not required. The measurement described here yields physical data that may be used for: (1) rating apparatus according to its sound power output, (2) establishing sound control measures, (3) predicting sound pressure levels produced by a device or machine in a given enclosure or environment. However, the detailed methods for utilizing the data for these purposes are not included in this standard.

Petrusewicz, S. A.
CRITERIA AND STANDARDS
Noise and Vibr Control for Ind, Conf, (Bath, Eng, Apr 10-12, 1972)

Almost every major industrial country has issued standards relating to noise, noise measurement and criteria. A high degree of standardization and similarity between national standards was achieved by the international organization for standardization (ISO) where participating countries agreed on a common new standard and then based their national standards on ISO. British standards are either identical with ISO or have some differences to suit particular conditions. Noise criteria are generally not standards (although the method of derivation is) and are usually either recommendations which cannot be legally enforced or acts of Parliament which can be legally enforced. All British noise standards are considered; most commonly used criteria applicable to industrial noise are described fully.

Schneider, A. J.
RELATING ACOUSTICAL MEASUREMENTS TO SAE PROCEDURES
SAE Prepr N 740212 for Meet, Feb 25 - Mar 1, 1974

The measurement of noise can be a rather complicated task. At least, it must not be taken for granted. One problem is that noise is a dynamic phenomenon. The other problem is that a microphone often affects the acoustical field it is trying to sense. These are strange phenomena to those of us who deal only with slowly varying signals and with transducers which do not affect their environment. The object of this paper is to list and explain the precautions that must be taken when measuring noise and documenting acoustical data for SAE criteria.

Van Doeren, R. E.
ON THE REALITY AND PRACTICALITY OF STEADY-STATE AND PULSE-TRAIN (TRANSIENT) ACOUSTIC MEASUREMENTS
Inst of Environ Sci, Annu Tech Meet, 19th, Proc, (Anaheim, Calif, Apr 2-5, 1973) p 301-306

This paper discusses the nature of acoustic noise as encountered in the real world and the type of design information which would be most useful to the engineer attempting to design or modify an acoustic system. The present day standard acoustic measurement test techniques are discussed and their advantages and shortcomings are pointed out. It is concluded that today's standard test methods are not realistic and are relatively impractical. The concept of application of transient acoustic test techniques is advanced, application of trains of tone burst pulses to acoustic measurements is discussed and some pulse train measurement results are presented.

TRANSPORTATION NOISE

Vehicle Design

Aspinall, O.T.
CONTROL OF ROAD NOISE BY VEHICLE DESIGN
J Sound Vibr, v 13 n 4, Dec 1970, p 435-44

The work of vehicle noise reduction is illustrated by an example in which the effects of exhaust silencing and various designs of engine enclosure are illustrated. It is concluded that it is possible, but not necessarily practicable, to get down to an ISO test level of about 80 dBA with the appropriate amount of engine enclosure at weight penalty of 9 lb/dBA. However, space limitations on vehicles fitted with larger engines than those used in this work may make the fitting of an enclosure extremely difficult, and may necessitate considerable redesign of the vehicle.

Berry, W.C.
PRACTICAL MEANS OF IMPLEMENTING VEHICLE NOISE CONTROL - 2
J Sound Vibr, v 13 n 4, Dec 1970, p 459-60

Palliative treatment by engine - gearbox enclosure and by attention to the exhaust system can give some 7 to 8 dBA reduction of noise: a weight penalty of 10 lb/dBA and a cost penalty of 60 to 80 shillings/dBA one results from these treatments: to reduce exhaust noise, engine enclosure can be conveniently effected by absorbent - lined steel panels although practical difficulties can occur with existing vehicles: the choice of absorbent material is restricted by lubricating and fuel oil contamination and the resultant fire hazard:

Crosby, M. J.
CAB ISOLATION AND RIDE QUALITY
SAE Prepr n 740294 for meeting Feb 25-Mar 1 1974

Improved ride quality through cab isolation on tractor semitrailers is predicted. Analysis techniques, test data, and ride evaluation criteria are described which have been used to design cab isolation systems. Computer simulations of improved cab ride are presented for both conventional and cab-over-engine tractors.

Emme, J.
CORRELATION OF STANDARD TRUCK CAB INTERIOR NOISE TESTS TO OPERATIONAL NOISE
SAE Prepr n 720699 for meeting Aug 21-24 1972

His paper presents the results of two studies which are concerned with the noise level experienced by the truck driver during actual operation. The first study's purpose was to determine the noise level of actual operation while the second study compared actual operational noise to the noise level that was produced during three standard test methods. The three standard test methods were SAE recommended practice J336, high idle and constant 50 mph operation.

Galloway, W.J.
MOTOR VEHICLE NOISE
Inst Environ Sci Proc, 17th Annual Tech Meeting, Living in our Environment,
Los Angeles, Calif, Apr 26-30 1971, p 393-397

This paper examines the overall noise characteristics of automobiles, motorcycles and heavy trucks. Consideration is then given to how they aggregate into what is generally described as "traffic [illegible] 2 refs.

Galloway, W.J.; Jones, G.
MOTOR VEHICLE NOISE. IDENTIFICATION AND ANALYSIS OF SITUATIONS CONTRIBUTING TO ANNOYANCE
SAE pap 720276 for meeting Jan 10-14 1972

An interview survey of 1200 respondents in three cities identified 12 vehicle type/noise source/operating mode situations causing various degrees of annoyance. Each situation was assigned to one of three categories of annoyance sensitivity depending upon the attitudinal factors related to the source. Each category had a linear relationship between noise intensity and annoyance. Noise measurements indicated that the respondent, in general, properly identified the types and magnitudes of noise sources found at their sites. 10 refs.

Hakimi, A.H.
MOUNTS TO REDUCE TRACTOR CAB NOISE
Agr Eng, v 52 n 7, July 1971, p 370-1

The performance of resilient (antivibration) mounting elements through which the cab is attached at each mounting position to the tractor chassis is investigated by noise level determinations at the position of the operator's ear with the cab fitted with various mounts and also rigidly attached, vibration studies to enable the functions of the resilient elements to be understood, impact tests of safety frames fitted with the mounts to demonstrate their ability to withstand an overturning accident, and determination of simple dynamic characteristics of the mounts to define their stiffness and damping.

Hartley, J.
AMERICANS REDUCE TRUCK NOISE BY ENCAPSULATION
Noise Control Vibr Reduct, v 5 n 2, Mar 1974, p 81-84

Methods and results are reported concerning a noise abatement program for diesel trucks sponsored by the United States Department of Transportation (DOT), and some comparisons are made with the British Department of Environment's "quiet lorry" program. The standard American heavy diesel trucks have a noise level of 88 dBA. Noise-level treatment without enclosure has reduced this to 79-80 dBA in two cases; treatment plus enclosure has further reduced noise output to 77 dBA for the same trucks. A third truck with treatment plus enclosure attained a level of 72 dBA. Because these noise levels in the American SAE test are measured at a greater distance than in the British standard or ISO (International Standards Organization) test, the American figure should be increased by about 5 dBA to be comparable. However, the target for the "quiet lorry" program is 80 dBA, so the best American effort is about 3 dBA quieter.

Hutton, T.D.
HOW LOUD ARE DIESEL TRUCK CABS?
SAE pap n 720698 for meeting Aug 21-24 1972

This study investigates the intensity and the duration of noise exposure to which a driver is subjected during actual freight hauling, over-the-road operation of cab-over-engine, intercity, diesel trucks on typical western interstate freeways. To do this, a practical instrument package was developed for recording dBA noise levels over extended periods of time. The noise levels produced during extended operation are compared with results of single decibel readings taken under various circumstances with the tractor stationary and accelerating. A determination is made as to whether the driver's occupational noise exposure is within the limits specified by Walsh-Healey for the various tranctors tested.

Kleinhoonte, Van OS G.J.
MOEGLICHKEITEN ZUR BEWERTUNG UND BEURTEILUNG DER GERAEUSCHE IN KRAFTFAHRZERUGEN. (METHODS FOR ASSESSMENT AND RATING OF NOISE IN AUTOMOBILES).
VDI Berg n 188, 1972 for meeting, Duesseldorf, Ger, Jan 13 1972, p 9-14

Causes of noise generated by automobiles and noise rating methods are discussed. The proposals for noise abatement solutions are also made. 8 refs. in German.

Lemiere, B.
TECHNIQUE FT METHODS DE MESURE DU BRUIT INTERIEUR DES VEHICULES AUTOMOBILES. (METHODS FOR MEASURING THE NOISE INSIDE AUTOMOBILES).
Ing Automob n 8-9, Aug-Sept 1973, p 485-495

A survey of instruments and methods used to define and record various noises generated by automobiles is made, in French.

Lewis, R.P.
PRACTICAL MEANS OF IMPLEMENTING VEHICLE NOISE CONTROL - 1
J Sound Vibr, v 13 n 4, Dec 1970, p 455-57

Traffic surveys in England revealed a drop from 34 to 25% in the number of vehicles exceeding 92 dBA the legal noise limit; development of noise-reducing modifications to a truck to reduce its level from 93 to 89. 3 dBA are described and it is concluded that this is about the limit of feasible noise reduction that can be achieved by the vehicle manufacturer without assistance from his engine supplier:

Muster, D.
MECHANICS OF NOISE GENERATION BY GROUND TRANSPORT VEHICLES
ASME AMD V 5 1973, for meeting, Detroit, Mich., Nov 1973, p 153-176

Motor vehicle noise is discussed in terms of the individual noise sources in trucks, automobiles and other vehicles. The sources include the engine and transmission, the tires, and the body of the vehicle and its appurtenances. There are several physically different mechanisms by which a motor vehicle noise is generated. They are loosely grouped as being mechanical (impact, vibration), aerodynamic (interrupted flow, turbulence) and acoustic (exhaust and induction, tire/roadway interaction, combustion processes). The character of the mechanisms and their relative importance to the overall vehicle noise spectrum are discussed. 61 refs.

Olson, N.
SURVEY OF MOTOR VEHICLE NOISE
J Acoust Soc Am v 52 n 5, part 1, Nov 1972, p 1291-1306

A statistical treatment is given for transportation noise in urban areas to establish consistent noise emission characteristics. Categories are passenger cars, light, medium and heavy trucks, tractor trailers, cement mixers, and motorcycles. Sound levels were recorded continuously at five locations for 24 hours periods and analyzed for percentile distributions in each one-hour interval.

Price, R.J.G.
MEASUREMENT AND CONTROL OF COMMERICAL VEHICLE NOISE
Diesel Eng Users Assoc Purl, n 351, July 1972, p 1-12

This paper describes the measurement of the noise levels of diesel engine commerical vehicles under practical test conditions. The analysis of these results and the application of simple noise reduction treatments. Noise levels are recorded using a precision sound level meter set to fast response. Units specified are 'A' weighted decibels, termed dBA, which are now almost universally accepted for vehicle external noise measurement.

Priede, T.
ORIGINS OF AUTOMOTIVE VEHICLE NOISE
J Sound Vibr, v 15 n 1, Mar 8 1971, p 61-73

The characteristics of the noise produced by the various major elements of a vehicle are discussed and it is concluded that any of these can be predominant sources of noise within a particular operating range of the vehicle. It is shown that the noise emitted by the vehicle elements is determined primarily by the operational speed.

Sellon, R.
SOUND ATTENTUATION IN OPERATOR ENCLOSURES
SAE Prepr n 720701 for meeting Apr 27 1972

This paper outlines parameters for the design of operator's enclosures (cabs), with special reference to noise control. Specific suggestions for the solution of noise pollution include shock mounting of the cab, plugging all holes through which noise can enter, attentuating large sheet metal areas by damping, effectively using large amounts of glass, diverting the exhaust outlet away from the cab, providing a fan shroud, not mounting sound generating components to enclosure walls. Such steps should reduce the sound level by 15-20 dB, but will add 12-15% to the overall cost of the enclosure.

Shedlowsky, J.D.
IMPORTANCE OF ACOUSTICAL LEAKS IN PASSENGER CAR BODIES
SAE pap in 720507 for meeting May 22-26 1972

In its treatment of acoustical leaks in passenger car bodies, this paper considers the general principle of noise control in a passenger compartment, the concept of acoustical leaks, examples of such leaks, and design guidelines for acoustical isolation. The guidelines include elimination of unnecessary holes in the body sheet metal; relocation of necessary holes to less critical areas; minimization of trim intersections and avoidance of alignment of body shell holes with trim intersections.

Spellacy, F.
PRACTICAL MEANS OF IMPLEMENTING VEHICLE NOISE CONTROL - 3
J Sound Vibr, v 13 n 4, Dec 1970, p 461-3

Some detailed engine modifications to reduce noise are dicussed, but the main area for noise reduction lies in palliative treatment; such treatments include the use of absorbent materials in the existing engine compartment and with additional engine covers; in developing exhaust systems the noise radiated by the pipes and muffler casings has to considered in addition to the gas noise emitted from the tail pipe; cooling fan noise can also be a problem; transmission noise, becomes important as engine noise is reduced; turbocharging is mentioned.

Staadt, R.L.
LESS NOISE FROM DIESEL TRUCKS
SAE Prepr n 730712 for meeting Aug 20-23 1973

An indepth study to reduce noise produced by a typical highway diesel truck is being conducted to determine levels and costs attainable by practical means. Truck noise reduction involves isolating several individual noise sources, that is, fan, exhaust, engine-radiated, intake system, and others, and developing means to reduce each. Tire noise and major engine revisions are not considered in this project. Goals of 78 dBA (per SAE J366A) without engine enclosure and 75 dBA with engine enclosure are believed possible on the vehicle configuration being studied. This project is sponsored by the U.S. Department of Transportation Office of Noise Abatement, and Industry.

Thompson, J.W.
ENGINEERING APPROACH TO DIESEL TRUCK NOISE REDUCTION
SAE Prepr pap n 730713 for meeting Aug 20-23 1973

This paper describes the White Motor Corp. approach to heavy-duty diesel truck noise reduction, as part of the U.S. Department of Transportation quiet truck program. A unique "free field" stationary vehicle noise test facility was designed and built for noise control development. The features of this facility and the techniques employed in vehicle noise source identification are presented. The static free field test facility has proven to be a useful tool for noise source identification testing. The data generated by this test method are useful on the basis that no corrections are necessary since all components are tested in their normally installed environment. The data which have been accumulated have been repeatable. A sum of the component data accumulated has been very close to the total system noise measurement, which is an indication that the subcomponent data are realistic.

Turner, A.E.
DEVELOPMENT OF VISCO-ELASTIC DAMPING MATERIALS FOR APPLICATIONS INVOLVING LARGE TEMPERATURE FLUCTUATIONS
Environ Eng n 49, June 1971, p 13-15

Use of various polymers for damping vibrations and noise in engines of road vehicles is discussed. Methods of extending the damping region, an application of damping treatment, constrained layer damping and diesel engine noise are dealt with.

Vargovick, R.J.
NOISE SOURCE DEFINITION, EXTERIOR PASSENGER VEHICLE NOISE
SAE pap 720274 for meeting Jan 10-14 1972

A drive-by exterior noise program was conducted to determine the contribution of each car noise source-engine/exhaust, fan, and tire/roadway-to the total exterior drive-by noise of a passenger vehicle. A 1970 high- and low-power sedan and a 1970 high- and low-power sporty compact were utilized in the test sequence. Octave-band and dBA sound levels were recorded with the m microphone positioned 25 ft away for various modes of vehicle operation at cruise and wide-open-throttle conditions. Results indicate for cruise (road-load) conditions that, except for high-performance vehicles, the predominant source of exterior vehicle noise above 500 Hz is tire/roadway noise. The major sources of exterior noise below 500 Hz are both engine/exhaust noise and tire/roadway noise. Fan noise is an insignificant contributor to passenger vehicle exterior noise at present noise levels. 10 refs.

Tire Noise

Hillquist, R.K; Carpenter, P.C.
BASIC STUDY OF AUTOMOBILE TIRE NOISE
SV Sound Vibr, v 8 n 2, Feb 1974, p 26-28

A basic parametric study of automobile tire noise has been conducted to determine which operating and conditional factors have significant influence on the observed sound levels. Tires representing current original equipment installations and variants in regard to both tread design and carcass construction are included in this study. It was concluded that the most significant factor affecting tire noise is vehicle speed, while road surface texture is of lesser importance, 2 refs.

Thurman, G.R.
CHARACTERISTICS OF TRUCK TIRE SOUND
SAE Spec Publ n SP-373, 1972 pap 720926, p 18-21

The sounds produced by truck tires running at highway speeds consist of a fundamental at a frequency of 300-400 Hz and several higher harmonics of the fundamental. Varying the tread-pattern pitch length causes the fundamental, and as a consequence the higher harmonics, to be made up of several tones bunched in less than one-third octave. The more aggressive tread designs used on drive axles produce higher sound levels and sounds richer in the higher harmonics than do rib type tires. The high persistence and singing or tonal nature of the sounds produced by certain tread designs may generally be associated with high third or fourth harmonics in the sound.

Wik, T.R.; Miller, R.F.
MECHANISMS OF TIRE SOUND GENERATION
SAE Spec Publ n SP-373, 1972 pap 720924, p 4-11

Read pattern and tire nonuniformities are found to contribute a periodic acoustic-pressure variation. The road surface cavities and the random air turbulence contribute an aperiodic acoustic-pressure variation. The periodic component exhibits spectral peaks at discrete frequencies and the aperiodic component exhibits a continuous spectrum. The frequencies of spectral peaks produced by the tread pattern, the road surface cavities, and the tire nonuniformities are directly proportional to the tire speed. 7 refs.

Preliminary Investigations

Underwood, M.C.P.
PRELIMINARY INVESTIGATION INTO LORRY TIRE NOISE
Transp Road Res Lab (GB) Trrl Rep Lr 601 1973

An investigation has shown that, although tire noise does not contribute significantly to levels measured in the British standard drive-by-test, tire road surface noise will be the predominant source of noise from envisaged quieter heavy motor trucks when they are traveling at speeds approaching 100 km/hr on dry roads and at speeds over 50 km/hr on wet roads. 12 refs.

Zoeppritz, H.P.
POSSIBLITIES AND LIMITATIONS IN TIRE NOISE REDUCTION, (MOEGLICHKEITEN UND GRENZEN DER VERMINDERUNG DES REINFEN-ABLAUFGERAEUSCHES)
Automobiltech z v 74 n 1, Jan 1972, p 1316

Requirements for tire quality and noise generation are studied for an interaction. The results of noise measurement tests on passenger cars and trucks are evaluated with comparison to tire tread patterns, in German.

Standards and Practices

Dougherty, G.M.
SOUND LEVELS OF HIGHWAY TRUCK TIRES, PROPOSED SAE RECOMMENDED PRACTICE XJ57-1. DRAFT OF SAE XJ57
SAE Spec Publ SP-373, 1972 pap 720927, p 22-30

SAE XJ57 is based on over five years of testing and over three years of combined efforts expended by truck manufacturers, tire manufacturers and other participating groups. The test is primarily a tire qualification standard, since the effects of the truck and other sound sources must be minimized so that the tire sounds can be measured. The specified measurement is dBA slow response so that correlation (objective and subjective) and consistency can be obtained. Spectral analysis of the tire sound is recommended as a tool for defining problem areas, elaborating on tire design differences, and separating tire sound from vehicle sound, especially for ranked tire sounds. 5 refs.

Lippmann, S.A.
ESTABLISHING A TESTING STANDARD FOR TRUCK TIRE SOUNDS
SAE Spec Publ n SP-373, 1972 pap 72093, p 1-3

This paper reviews the objectives and approaches of the SAE truck tire noise subcommittee, whose work has resulted in the formulation of a tire testing procedure and a consolidation of requirements to be incorporated into a proposed standard. Tesing indicated that worn tires tend to be noisier than new ones, probably on account of irregularities in the contour of the treading.

Subjective Evaluations

Hillquist, R.K.
EXPERIMENT FOR RELATION OBJECTIVE AND SUBJECTIVE ASSESSMENTS OF TRUCK TIRE NOISE
SAE Spec Publ n SP-373, 1972 pap 720928, p 31-40

Test runs involving six trucks, eighteen sets of tires and five vehicle operating modes were randomly presented in test runs to a jury situated alongside a highway. The A-weighted sound level is shown to correlate well with subjective ratings of truck tire noise; thus adding this component of transportation noise to the list of those other vehicle noises already demonstrated to be adequately evaluated by simple sound level measurements. 6 refs.

Lippmann, S.A.
JURY REACTIONS TO TRUCK NOISE - AN SAE STUDY
SAE Spec Publ n SP-373, 1972, pap 720929, p 41-56

The A-weighted sound level accounts for the bulk (but not all) of the jury's reaction to the sound of trucks coasting on a variety of tires. A component of the jury's reaction is related by the study to the manner in which the sound decays after the vehicle passes the point of observation. The component also appears to depend strongly on the characteristics of the sound. The jury's reaction shows two forms of distortion: end-of-scale compression and temporal drift. The analysis attempts to account for these factors and to see beyond them into the jury's basis for reacting.

Lippmann, S.A.
HOW JURY RANKS TIRE NOISES
SAE J Automot Eng v 80 n 8, Aug 1972, p 40-41

Subjective annoyance ratings correlate strongly with objective dBA scale but are distorted by scale and compression, sound quality, and drift with time. Charts are utilized to show noise ratings for various tire tests.

"Good Tire" Characteristics

Peterson, K.G.; Rasmussen, R.E.
WHAT MAKES A GOOD RADIAL TIRE?
Automot Eng, v 81 n 6, Jun 1973, p 52-56

For new radial tires, vehicle/tire performance is mainly influenced by mechanical properties, such as: dimensions, handling, ride, traction, noise and power loss. Tables show test results for force and moment properties, radial tire force and moment parameters and spring rate at 26 psi.

Effects of Operational Parameters

Corcoran, D.A.
EFFECTS OF OPERATING PARAMETERS ON TRUCK TIRE SOUNDS
SAE Spec Publ n SP-373, 1972 pap 720925, p 12-17

Sound level measurements were obtained for a variety of tires on a variety of surfaces, and many test parameters were varied to investigate their influence on the measured level of sound. Cross-ribbed tires produce sound levels higher than circumferentially-ribbed tires, on an order of 5-10 dB, depending on wear. A tire rolling on a smooth surface produces more noise than one rolling on a coarse surface. Sound level increases with wheel speed and appears to follow a 40 log V relationship. Tire size does not influence sound level. 10 refs.

Diesel Engine Noise

Noise Reduction Techniques

Anon
DIESEL-ENGINE NOISE CAN BE REDUCED
SAE J Automot Eng v 81 n 1, Jan 1973, p 42-45

Noise reduction of 9 dBA has been achieved with an experimental diesel engine by using stiffer block, isolated panels, and damped surfaces, by removing bottom part of crankcase skirt, and by adding single bearing beam. Most of sound reduction appears due to use of covers and isolated components. Construction and performance details are compared with a conventional engine.

Anon
VIBRATOR AND NOISE IN MOTOR VEHICLES
London: Institution of Mechanical Engineers, 1972

Both theoretical and practical approaches to the problem of vibration and noise in motor vehicles were considered during the symposium. Among the motor vehicles noise sources investigated are internal-combustion engines and their exhaust systems, engine mountings, crank shafts, rear axles, drivelines, brakes and brake discs, tires and roads, engine hum, and gear noise. Discussions during the 4 sessions of the symposium are also included.

Averill, D.; Patterson, W.N.
DESIGN OF A COST-EFFECTIVE QUIET DIESEL TRUCK
SAE Prepr n 730714 for meeting Aug 20-23 1973

This paper reports the results of a project whose aim was to develop a quiet truck in a cost-effective manner. In the paper a method of approach to identification of noise sources and diesel truck noise control is presented, along with a demonstration of noise control techniques and the results obtained. The final drive-by noise level, as measured by SAE J366A procedures, was 74 dBA. The approach was to take a standard production truck and modify its exhaust system, fan, transmission, and cab enclosure. Although no modifications were made to the engine, a quieting kit consisting of dampening panels was fitted to it.

Brzozka, G.
EINE KLASSIFIKATIONSMETHODE VON VIERTAKT-DIESELMOTOREN NACH IHREM GERAEUSCH
(NOISE RATING OF FOUR-STROKE DIESEL ENGINES)
Mtz Motortech z v 34 n 2, Feb 1973, p 55-57

A classification of diesel engines, according to the noise they generate, is made into five groups. The classification is made using statistical data and the volume of noise at different speeds. A nomogram is presented for a simplified classification method. 6 refs, in German.

Dyer, T.R.; Lundgaard, B.
NOISE CONTROL ON DIESEL TUGS
Mar Technol v 10 n 4, Oct 1973, p 321-333

Briefly gives basic acoustic definitions and explains the fundamental concepts used in noise control. The mechanics of noise generation and the various methods used in noise suppression are explained. The silencing program employed on two sister tugs, Edith Lovejoy and Anne Carlander, is described in detail. The acoustic treatment of the tugs is not identical and the resulting noise level differences are discussed. Alternative acoustic approaches are described and evaluated. The paper is illustrated with graphs and table of noise levels, and shows typical vessel arrangements and acoustic treatment details. 11 refs.

Fielding, B.J.; Skorecki, J.
IDENTIFICATION OF MECHANICAL SOURCES OF NOISE IN A DIESEL ENGINE: SOUND ORIGINATING FROM PISTON SLAP
Inst Mech Eng Proc (Part 1), Gen Proc v 184 n 46, 1969-70, p 859-74

The mechanism and radiation of sound generated by the piston slap of a diesel engine is investigated by standard methods of sound and vibration analysis augmented by correlation of incidence of individual transient components: this latter technique utilizes information obtained from the tuned outputs of the noise signal, focusing attention on the incidence of single- frequency transients: the contribution of piston slap to the overall piston's transverse motion is studied analytically and experimentally: 19 refs.

Grover, E.C.; Lalor, N.
A REVIEW OF LOW NOISE DIESEL ENGINE DESIGN AT I.S.V.R.
J Sound Vibr, v 28 n 3, June 1973

The basic relation between the exciting forces, the vibration characteristics, and the emitted noise of a diesel engine is described. Low noise design principles were formulated and applied to a variety of engine structures to demonstrate that these principles are feasible in practice. Two such engines, both of which gave overall noise reductions of about 10 dB, are described.

Grover, E.C.; Priede, T.
REDUCING NOISE OUTPUT OF AUTOMOTIVE DIESEL ENGINES
Diesel Gas Turbine Progr v 37 n 8, Aug 1971, p 22-3

A study has been conducted of ways to reduce the general engine noise by completely enclosing the engine within the engine compartment, from the results of research, practical and economic design for a low noise engine structure are suggested.

Huber, E.W.; Wodiczka, E.
BESTIMMUNG DES VERBRENNUNGSGERAEUSCHES VON DIESELMOTOREN MIT VERSCHIDENEN VERBRENNUNGSVERFAHREN. (ANALYSIS OF COMBUSTION NOISE OF DIESEL ENGINES WITH VARIOUS COMBUSTION SYSTEMS)
Mtz Motortech Z v 33 n 9, Sept 1972, p 351-356

Experimental results, obtained from various diesel engines, are evaluated. Noise generating components are analyzed. The method for investigation techniques is explained.

Jenkins, S.H.; Kuehner, H.K.
DIESEL ENGINE NOISE REDUCTION HARDWARE FOR VEHICLE NOISE CONTROL
SAE Prepr n 730681 for meeting June 18-22 1973

A range of hardware has been developed and put in production for three basic diesel engine models. The hardware includes parts for the isolation of components and shields mounted externally to the engine. Overall engine noise reductions in the test cell are as much as 6 dBA. The reduction of noise by external methods has been taken to the point where, in many cases, the noise is now distributed evenly from the engine surfaces. Treatment of any one surface, henceforth, will result in less significant reductions in total engine noise. 15 refs.

Jenkins, S.H.; Lalor, N.; Grover, E.C.
DESIGN ASPECTS OF LOW-NOISE DIESEL ENGINES
SAE Prepr n 730246 for meeting Jan 8-12 1973

Methods of reducing the noise level of a diesel engine include the suppression of the major modes of block vibration and treatment of the external surfaces. Design methods enable the frequencies and noise levels of these modes to be calculated for a conveniently designed engine. Experimental determination of the important modes of vibration, the noise signature and the effect of block modifications on a standard production v-8 engine provided the basis for design of an experimental low-noise engine. Design features include a stiffer block removal of the bottom part of the crankcase skirt. The addition of a single bearing beam, and the use of isolated panels and damped surfaces. The noise reduction obtained was 9 dBA. Most of this is due to the use of isolated and damped nonload carrying surfaces. 9 refs.

Jenkins, S.H.; Kuehner, H.K.
LOWERING DIESEL NOISE THROUGH HARDWARE MODIFICATIONS
Automot Eng v 81 n 6, June 1973, p 41-47

Isolation, shielding, and damping of individual diesel engine components can reduce overall noise level from 3-6 dBA. This practical approach shows how noise can be lessened by step-by-step analysis of each component. 3 refs.

DIESEL ENGINE AND HIGHWAY TRUCK NOISE REDUCTION
SAE Prepr n 730240 for meeting Jan 8-12 1973

A large performance test cell was modified for basic engine noise studies on a BV-71 engine. An elaborate exhaust system was installed to eliminate most of the exhaust noise. Air intake noise was reduced with a large oil bath cleaner having acoustical treatment on the cleaner and the air inlet pipes. Cooling fan noise was eliminated by using a water heat exchanger to maintain engine water temperature. The transmission was acoustically treated. Engine noise reductions of the following order were determined possible through modification: 1-3 dBA by engine modifications; 3-5 dBA by covers and panels; 5-8 dBA by total close-fitting covers and 8-15 dBA by enclosures.

Raff, J.A.; Perry, R.D.
A REVIEW OF VEHICLE NOISE STUDIES CARRIED OUT AT THE INSTITUTE OF SOUND AND VIBRATION RESEARCH WITH A REFERENCE TO SOME RECENT RESEARCH ON PETROL ENGINE NOISE
J Sound Vibr v 27 n 3, June 1973

Commerical vehicle noise was studied, with particular attention to the diesel engine as a noise source. Complementary investigations concerning the behavior of vehicles in their real environment and the means of controlling vehicle noise are discussed. Gasoline engine noise and its dissimilarity to that produced by diesel engines are also described. The relationshiops between the vehicle noise sources and their contributions to the interior and exterior environment are discussed, and some effects of road planning and vehicle operations are evaluated.

Russell, M.F.
AUTOMOTIVE DIESEL ENGINE NOISE AND ITS CONTROL
SAE Prepr n 730243 for meeting Jan 8-12 1973

Here is a wide variety of structural resonance in both working parts such as the crankshaft and connecting rod in the external surfaces, but with the exception of the thin sheet steel sumps and valve gear covers The number of resonances is not so large as to preclude an analysis of the structure response to find its major constituent normal modes. This analysis and a knowledge of the relative importance of the mechanical noise sources and the combustion pressure transient, provide the fundamental information upon which a scientific program to develop quieter engines from existing designs can be based. The actual noise reduction treatments may include both structural modification and control of noise at source. 8 refs.

Russell, M.F.
REDUCTION OF NOISE EMISSIONS FROM DIESEL ENGINE SURFACES
SAE pap 720135 for meeting Jan 10-14 1972

Analysis of the vibration of the external surfaces of several in-line engine structures has shown how noise can be reduced, provided that all the thin-section areas of the external surface are treated. Noise-reduction techniques have been evolved for all the commonly used surface structures for diesel engines, and these are described in this paper. Four in-line diesel engines have been treated by these techniques, and noise reductions of 5 to 8 dB have been obtained. In all cases, the same manufacturing plant was used to machine the modified crank-case/cylinder block casting; the valve gear cover and sump were modified versions of those already fitted to the engine.

Thien, G.; Nowotny, B.
INFLUENCE OF ENGINE STRUCTURAL VIBRATIONS ON DIESEL ENGINE NOISE LEVEL, (UNTERSUCHUNGEN UEBER DEN EINGLUSS VON KORPERSCHALLYORGAENGEN AUF DAS GERAEUSCH VON DIESELMOTOREN)
Mtz Motortech Z v 32 n 6, June 1971, p 185-93

A description is presented of the rig and measuring method which enable a follow up analysis of noise generation process by means of combustion simulation. The results obtained may play important role in noise abatement problem solutions. A study is made with different bearings by measuring of generated noise levels. 8 refs, in German with English abstract.

Operational Changes

Anderton, D.; Baker, J.
INFLUENCE OF OPERATING CYCLE ON NOISE OF DIESEL ENGINES
SAE Prepr n 730241 for meeting Jan 8-12 1973

The fundamental effect that cycle difference of a reciprocating internal combustion engine has on noise and performance, together with noise and vibration characteristics of two- and four-cucle diesel engines, is described. Some of the conclusions drawn from extensive noise and vibration measurements include: 1. variation in engine surface vibration and noise radiated is linearly related to a force input applied to the structure. 2. a method of predicting combustion noise levels of current automotive diesel engines. 3. a combination of engine performance calculations with relations for predicting overall engine noise in initial design stages. 10 refs.

Miyamoto, N.; Murayama, T.; Fukazawa, S.
STUDIES ON LOW COMPRESSION RATIO DIESEL ENGINE
Bull JSME v 15 n 90, Dec 1972, p 1603-1616

Performance values, such as thermal efficiency, were calculated stepwise based on Wiere's combustion function, and the relationships between the combustion rate and each performance value were investigated. In addition, the harmonics of engine noise were considered to be related to that of the of the cylinder pressure variation, hence, the harmonics of cylinder pressure variation were calculated for the estimation of noise emission When the combustion rate was controlled to a desired free value with a low compression ratio, performance factors such as thermal efficiency, maximum pressure, combustion noise and maximum combustion temperature could be improved simultaneously. 7 refs.

Scott, W.M.
NOISE OF SMALL INDIRECT INJECTION DIESEL ENGINES
SAE Prepr n 730242 for meeting Jan 8-12 1973

A study of all aspects of noise generated by small indirect injection diesel engines has been made, primarily aimed at the reduction of idling noise. This is a major problem in the application of diesel engines to taxis and light commercial vehicles when compared with the gasoline engine. The inherent advantage shown by the indirect injection system, in terms of smoke, noise, and gaseous emissions, is resulting in an extension of its application into larger commercial vehicles. Combustion is shown to be the major noise source under both idling and high-load, high-speed conditions, and means of reducing this by control of fuel injection are described, together with the reduction of the other noise sources contributing to the annoyance aspect of idling noise.

Tiede, D.D.; Kabele, D.F.
DIESEL ENGINE NOISE REDUCTION BY COMBUSTION AND STRUCTURAL MODIFICATIONS
SAE Prepr n 730245 for meeting Jan 8-12 1973

Both combustion system improvements and structural modifications can result in significant engine noise reductions, on naturally aspirated diesels, combustion can be identified as the major excitation force by comparison of changes in cylinder pressure spectrum and noise during various engine operating modes. Reducing ignition delay reduces combustion excitation in the critical, mid-frequency range and produces corresponding changes in noise. The amount of reduction obtained depends on the combustion and mechanical noise levels, but reductions up to 5 dBA are typical. At current engine noise levels, cylinder pressure oscillations do not contribute signficiantly to overlal noise levels. Structural modifications are required either to shift the major structural resonances out of the critical 400-3000 Hz frequency range or reduce response at these frequencies.

Covers and Shields

Hartley, J.
FRAMES AND COVERS
Automot Des Dengr, v 12, Dec 1973, p 22-23

Increased use of shielding is being utilized to reduce diesel engine noise. Modifications in engine cylinder block design are necessary for mounting. Tests with shielded engines shown noise reduction levels of up to 5-6 dBA. 1 ref.

Ronnhult, J.
REDUCING NOISE FROM HEAVY DIESEL TRUCKS BY ENGINE COMPARTMENT SHIELDING
SAE Prepr n 730682 for meeting June 18-22 1973

This paper describes how significant noise reduction can be attained merely by soundly designed shielding, without the need for modifying the basic design of the truck. The method is based upon experience from other types of vehicles which, for a number of years, have already been equipped as standard with similar insulation. The reduction attained in the noise emission is approximately 6 dBA. Inconvenience during repairs and service has been reduced to a minimum by a well-planned design and simple mounting of the shields as well as ample exposure of the engine when the car is tilted.

Thien, G.E.
MOEGLICHKEITEN ZUR SENKUNG DES GERAEUSCHPEGELS VONDIESELMOTOREN. (POSSIBILITIES OF REDUCING NOISE LEVEL OF DIESEL ENGINES)
Automobiltech Z v 74 n 7, July 1972, p 261-269

A summary of experimental results and studies on noise abatement of diesel engines is presented. Evaluation of various housing types and sound insulation materials is given, 17 refs. in German with English abstract.

Thien, G.E.; Fachbach, H.
NOISE ABATEMENT ON DIESEL ENGINES BY EXTERIOR MODIFICATIONS AND ENCASEMENT, (GERAEUSCHVERMINDERUNG AN DIESELMOTOREN DURCH AENDERUNG AEUSSERER BAUTEILE UND SCHALLDAEMMENDES VERKLEIDEN)
Mtz Motortech Z v 32 n 5, May 1971, p 145-52

Measures to abate noise of diesel engines are considered by means of building acoustic hoods around engines. The tests and investigations conducted with various noise deadening materials are reported. Several examples are demonstrated, 13 refs, in German with English abstract.

Thien, G.E.
USE OF SPECIALLY DESIGNED COVERS AND SHIELDS TO REDUCE DIESEL ENGINE NOISE
SAE Prepr n 730244 for meeting Jan 8-12 1973

Vibration isolation, stiffening, or sound-reducing shells, can be applied within comparatively short time; however, their effect on reducing the total noise is restricted to about 5 dBA. Total enclosure of the engine is highly effective. In this particular design, the space requirement is comparatively small, the weight increase is not too excessive, sound-absorbing material in the clearance is not required, and the noise reduction achieved is as high as 15-20 dBA. Both extreme damping or extreme stiffness will not suffice to achieve noise reduction of more than 10 dBA, 12 refs.

Engines

Anon
BROBECK STEAM BUS ENGINE CUTS EXHAUST EMISSIONS
SAE J Automot Eng v 80 n 9, Sept 1972, p 43-47

Engine developed for California steam bus demonstration also emits less external noise than original diesel. Fuel consumption, however, increases significantly. Performance characteristics for sections of the steam generator and auxiliary components are charted. Noise levels for a steam and diesel bus are also compared.

Anon
EXTERNAL COMBUSTION ENGINES CUT NOISE AND AIR POLLUTION
Des Eng (London), Apr 1971, p 66-8

Advantages of the external-combustion engine include low exhaust emissions and noise levels: two attempts by General Motors and one by Lear Corp. to utilize steam engines for powering automobiles have proven unsuccessful; a closed Rankine cycle steam engine with thiophene as the working fluid and a Sterling engine combined with the electric motor drive given promise of cleaner exhaust and efficiency competitive with the internal combustion gasoline engine;

Hanaoka, M.; Fukumura, S.
STUDY OF VALUE TRAIN NOISES AND A METHOD OF CAM DESIGN TO REDUCE THE NOISES
SAE Prepr n 730247 for meeting Jan 8-12 1973

This new method of cam design reduces valve train noises that occur at the instant the valve opens and closes, and those that occur while the follower is on the cam lobe. Valve noises are caused by impacts, and their sound intensity is proportional to the impact speed. Follower noises are caused by frictional vibrations due to metal-to-metal contact at points where oil film thickness becomes zero. Irregular contact surfaces increase these noises, and value train noises at high engine speeds are caused by irregular valve behavior. The profile of the new cam design is expressed by "N" th -order fourier series in 360 deg continuously, and has no high-order harmonics that resonate with the natural frequency of the train. Its wide parameter permits design of a most reasonable acceleration curve. Valve motion is thus improved and noise is reduced.

Kurnatov, V.D.
SHUM OT UDAROV PORSHNYA I PUTI EGO SNIZHENIYA. (NOISE GENERATED BY PISTON IMPACTS AND MEANS FOR ITS REDUCTION)
Energomashinostroenie v 11, Nov 1972, p 40-41

Mathematical expressions are derived for the energy of elastic vibrations of the cylinder sleeve as a function of its structural mutual relations; the analysis of these expressions makes it possible to determine optimum structural relationships of the piston contributing to the reduction of the noise generated by diesel engines, in Russian.

Lalor, N.
ORIGINS OF RECIPROCATING ENGINE NOISE WITH EM DASH ITS CHARACTERISTICS, PREDICTION AND CONTROL
J Soc Environ Eng n 55, Dec 1972, 6 p between p 12 and 21

Mechanisms of noise generation, the exciting forces, engine structural response, acoustic radiation efficiency, effect of operating and design parameters on overall noise level and noise control measures were studied. Design for low noise in-line engine is described, 9 refs.

Lukanin, V.N.; Alekseev, I.V.
ANALYSIS OF NOISE GENERATED BY AN INTERNAL COMBUSTION ENGINE
Izv Vyssh Ucheb Zaved, Mashinostr n 6, 1971, p 110-14

A physico-mathematical model is presented for the noise generation in an internal combustion engine (ICE). Relations are obtained for the calculation of spectral densities and levels of the oscillating motion of ICE parts, as well as levels and spectra of acoustic radiation. Some calculated spectra, frequency characteristics, and vibration levels of a diesel cylinder head are presented, in Russian.

Wunsch, A.
FOURIER ANALYSIS USED IN THE INVESTIGATION OF NOISE GENERATED BY PRESSURE-WAVE MACHINES WITH UNSYMMETRICALLY DIVIDED ROTORS
Brown Bov Rev v 58 n 4-5, Apr-May 1971, p 167-71

Since the machine is intended as the upper stage for the gas turbines for charging diesel engines in vehicles, means had to be found for reducing the noise which is similar to that of a siren. The tone of the noise was made less unpleasant by a symmetrical division of the rotor wheel. The noise level due to rotation can be reduced by this method, and a multitude of additional frequencies of low noise level are created. The pressure-wave machine model studies are reported, providing the theoretical background for noise control measures.

Intake and Exhaust

Blair G.P.; Coates, S.W.
NOISE PRODUCED BY UNSTEADY EXHAUST EFFLUX FROM AN INTERNAL COMBUSTION ENGINE
SAE Prepr n 730160 for meeting Jan 8-12 1973

Most noise from present-day gas-and diesel-powered vehicles comes from the engine and exhaust. It is the exhaust noise, and in particular that generated by the efflux of gas from the open end of the exhaust pipe, which is considered here. From a theoretical analysis of the unsteady efflux from the open end of a simulated reciprocating internal combustion engine exhaust system a prediction of overall and one-third octave sound pressure levels in space, due to this gas flow, is produced. The predictions are compared with measured levels and show a high degree of correlation, 29 refs.

Blair, G.P.; Spechko, J.A.
SOUND PRESSURE LEVELS GENERATED BY INTERNAL COMBUSTION ENGINE EXHAUST SYSTEMS
SAE Pap 720155 for meeting Jan 10-14 1972

A computer program has been developed which predicts the sound pressure level and the frequency spectrum produced by simple engine exhaust systems. The program utilizes unsteady flow gas dynamic theory to predict the pressure-time history in the exhaust system and the velocity time history at the open end of the system. Acoustic theory is then used to predict the sound pressure levels and frequency spectrum in free space. The work was carried out on a twin-cylinder four-cycle engine, but the theory can be applied to any internal combustion engine.

Bishop, C.
SILENCERS FOR RECIPROCATING ENGINE EXHAUST
Pollut Eng v 6 n 2, Feb 1974, p 37-38

Types and models of silencers for reducing noise superimposed on gas flow in a duct are reviewed.

Byrne, V.P.; Hart, J.E.
SYSTEMS APPROACH FOR THE CONTROL OF INTAKE AND EXHAUST NOISE
SAE Prepr n 730429 for meeting Apr 2-4 1973

An intake and exhaust system mathematical model has been developed with the ability to predict the effects of specific acoustical elements on acoustic system performance. This paper discusses typical systems, the acoustical elements that make-up the system, and a mathematical modeling of a system. It will also cover the effects of changing acoustical elements - exhaust and tail pipe lengths - on a noise spectrum.

Diboll, W.B.
MEASUREMENT AND PREDICTION OF EXHAUST FREQUENCIES IN LARGE INTERNAL COMBUSTION ENGINES
ASME pap 72-DGP-2 for meeting Apr 16-20 1972

To predict the frequencies a theoretical approach was developed in which fourier components of the exhaust pulses are combined at the correct time phase in the exhaust manifold. The theory has excellent agreement with field measurements. The determination of an engine's exhaust spectrum before installation allows the design of optimum mufflers of either expansion or resonator type. It is proposed that in some cases sound control can be effected by altering the firing order of an engine.

Kirkland, K.C.
ENGINE EXHAUST NOISE TEST FACILITY
SAE Prepr n 730427 for meeting Apr 2-4 1973

A patented test facility has been developed for the purpose of analyzing exhaust noise emissions. The facility isolates the exhaust system noise source and allows noise tests to be conducted under the SAE J366A test site conditions. The exhaust system is piped and positioned in a manner similar to that found on the vehicle. Noise tests are conducted under steady state engine speed and load settings resulting in a high repeatibility of test data.

Lind Walker, G.E.
SILENCING THE AUTOMOTIVE EXHAUST
N Z Eng v 27 n 12, Dec 1972, p 365-373

A patented silencer which used exhaust gas to heat and dry the outer case of the silencer, thus eliminating corrosion, was constructed. However, the chambered arrangement was found to amplify rather than silence exhaust noise at certain speeds. After a period of investigation and testing of engine speeds, a coherent theory of exhaust system acoustics emerged, and the final design is reported to be a good silencer constructed in accordance with the original patent, 11 refs.

Martin, H.
EXHAUST GAS NOISE SILENCERS ON TRUCK ENGINES, (ABGAS-SCHALLDAEMPFUNG AND SCHALLDAEMPFERAUFWAND MIT UND OHNE TURBOLADER AM KRAFTFAHRZEUGMOTOR)
Automobil Tech Z v 73 n 12, Dec 1971, p 449-51

Both methods and materials for noise abatement on trucks with engines having turbochargers are considered, 5 refs, in German with English abstract.

Mason, R.L.
PROGRESS IN THE REDUCTION OF DIESEL ENGINE NOISE
SV Sound Vibr v 8 n 2, Feb 1974, p 16-19

Noise reduction capabilities of a wide cross-section of intake and exhaust components, currently available for diesel engines, have been evaluated. The test techniques are presented and the results are summarized, 5 refs.

Rubayi, N.A.
ACOUSTIC VARIATIONS IN INTAKE MANIFOLD SYSTEM AND THE SUPERCHARGING OF ENGINES
Appl Acoust v 5 n 1, Jan 1972, p 39-53

The object of the present investigation is based mainly on the study of the acoustical phenomenon and the effect of the length and diameter of the inlet pipe on the compression pressure and hence on the supercharging of a multi-cylinder four-stroke gasoline engine over a wide range of engine speed, and also to determine an optimum length and diameter of intake pipe which would yield the maximum compression pressure, 21 refs.

Automotive Equipment

Cooling System

Cook, N.A.
ECONOMIC FACTORS IN RADIATIOR SELECTION
SAE Prepr n 720714 for meeting Sept 11-14 1972

This paper presents an analysis of the optimum radiator size for a given cooling load considering three types of cores. The sums of the first cost and operating cost is analyzed on the basis of return on investment using the method of discounted cash flow, an analysis of a standard line of radiators showing the relationship of total owning and operating cost versus engine cooling load is also presented. Total useful operating life is shown as well as operating hours per year. Curves of noise levels are also shown for this analysis to help provide a decision-making tool in the choice of radiators.

Fleischer, S.O.
METHOD FOR DETERMINING THE NOISE LEVELS AND PERFORMANCE PARAMETERS FOR TRUCK COOLING FANS
SAE Prepr n 730680 for meeting June 18-22 1973

A test method for accurately determining the noise levels of truck cooling fans, as a function of their performance, has been developed. Correlation between the calculated results, using this test method, and experimental results of tests with a simulated truck cooling system environment has been demonstrated. Since fan noise is a major component noise source for trucks, this procedure is of particular interest to engineers involved in meeting legislated vehicle noise levels.

Airbags

Hickling, R.
INVESTIGATION OF THE NOISE AND OVERPRESSURE GENERATED BY THE SAFETY AIR CUSHION
SAE Prepr n 740042 for meeting Feb 25-Mar 1 1974

The results of an experimental study of air cushion noise and overpressure are presented, and methods to reduce these effects are investigated. Free-field studies of inflator noise are made in an open anechoic room, and various silencing devices are tested. Studies are also made of the combined inflator noise and overpressure in a closed passenger compartment. Tests are made for different window openings in the compartment. Results are presented for a new experimental air cushion that draws in air from the passenger compartment as it inflates. Some of the implications of the data with regard to risk criteria for damage to human hearing are discussed, 13 refs.

Transmission

Dunlap, T.A.; Halvorsen, W.G.
TRANSMISSION NOISE REDUCTION
SAE Prepr n 720735 for meeting Sept 11-14 1972

This paper discusses the nature of noise production of automotive transmissions and the various measures which may be taken to reduce operating noise. The measures discussed include investigation and modification of the gear-shaft system dynamics in both bending and torsion. Also discussed are determination of dynamic characteristics of the transmission housing and ways of reducing the levels of vibration of housing areas and of decreasing the radiation efficiency of those areas.

Axle Gear

Bair, J.J.; Pickornik, W.; Melkerson, R.; O'Boyle, T.
AXLE GEAR NOISE QUALITY INSPECTION
SAE Prepr n 740110 for meeting Feb 25-Mar 1 1974

A gear tester has been developed that can predict the relative level of axle noise in the cab or a truck. This paper documents the development in five parts: establishing the characteristics of noise generated by the axle in the cab of a small gas powered truck, developing a viable gear tester for the noise quality measurement of spiral level gear sets, establishing correlation between gear tester ratings and in-truck ratings of axle noise, testing a random sample of gears to determine the population's noise quality distribution, and predicting the errors associated with using the gear tester in quality control.

Magnetic Propulsion

Polgreen, G.K.
QUIET TRANSPORT BASED ON NEW PERMANENT MAGNETS
Noise 2000, Assoc Intl Contre Le Bruit, Intl Congresses, pp 16-22, 1971

Electric motors suitable for vehicle propulsion first appeared commerically approximately 10 yr ago. But because of the inefficient, expensive magnetic problems involved, the electric railways and electric automobiles were generally scrapped in favor of noisy, unsafe fume-emitting internal-combustion engines. However, now permanent magnets have been improved a hundredfold; they can be made not only far more powerful, but at the same time lighter, simpler, and cheaper. Materially they are completely different from traditional metal magnets and generally take the form of shallow ceramic bricks and flexible rubber-bonded strips that can be cut to size with a knife. Electric machines for a future transport must therefore, be designed specially to deal with the advantages and peculiarties of these unfamiliar materials.

Locomotive Noise

Bondesen, A.
EFFECTIVE SOUNDPROOFING ON A 3900 HP DIESEL LOCOMOTIVE
Railway Gaz Intl v 129 n 7. July 1973, p 259-261

It is shown how experience gained in reducing the noise of a 3300 hp mz class diesel electric locomotive of Danish State Railways built by Ab Nohab, Sweden to that of a 1950 hp unit, made it possible to reduce noise emission of the 3900 hp turbo-charged version to between 76, 5 and 95 dBA.

Railyard Noise

Anon
BN STUDIES RETARDER NOISE ABATEMENT
Railway Sys Controls v 3 n 11, Nov 1972, 5 p between p 14 and 20

Burlington Northern has conducted several tests at three retarder classification yards to determine sound levels and effective means to reduce these levels as cars move through retarders. How the tests were carried out, and the conclusions from them are described.

Kendall, H.C.
NOISE STUDIED IN RETARDER YARDS
Railway Sys Controls v 2 n 7, July 1971, p 9-13

Measurements were made of noise created by cars moving through retarders in classification yards and results are presented diagrammatically. Results showed that reduction in sound levels may be obtained through the use of softer retarder shoe material. Use of special lubricants, increasing the mass of the shoe beams or construction of acoustic barriers.

Public Transportation

Bray, D.E.
NOISE ENVIRONMENTS IN PUBLIC TRANSPORTATION
Joint ASCE-ASME Transp Eng Meeting July 26-30 1971, Seattle, Wash,
Prepr 1469

Sound levels were measured at slow response on the A, B and C scales: the primary modes of public transporation are shown to have noise characteristics which are well defined in the passenger's personal space by both A-level measurements and by relative frequency content (A-levels VS)C-A(): The broad band of '%' currently acceptable '%' noise levels in transportation is demonstrated: 33 refs.

Bray, D.E.
NOISE ENVIRONMENTS IN PUBLIC TRANSPORTATION
SV Sound Vibr v 8 n 4, Apr 1974, p 16-20

Noise levels have been obtained at passenger seat locations on aircraft, buses and railcars while they were operating in regular commerical service. The data are graphically illustrated in model groups with cruise noise levels shown in dBA and as a point graph with cruise noise levels shown in dBA versus the difference value (dBC - dBA). 19 refs.

Colombaud, J.L.
NOISE AND VIBRATION LEVELS SUIT BALLASTLESS TRACK FOR UNDERGROUND RAILWAYS
Ral Eng Intl v 3 n 5, June 1973, p 235-240

Tests with three types of ballastless installations showed good results and slightly higher noise levels were alleviated by distributing a blanket of gravel aggregate along the sleepers. Advantages are reduced costs due to the elimination of ballast, lower structural height and reduced maintenance.

Harris, C.M.; Aitken, B.H.
NOISE IN SUBWAY CARS
SV Sound Vibr v 5 n 2, Feb 1971, p 12-14

Noise spectra inside cars on various subway systems are compared. Influence of car loading conditions, trackbeds, car designs, and operating conditions are considered, 6 refs.

Reybardy, J.
SOUNDPROOFING OF PASSENGER COACHES
Fr Railway Tech v 16 n 3, 1973, p 91-104

After reviewing basic principles of sound and hearing and acoustic measurement, and criteria for acoustic comfort, the author describes the sources of noise in railroad cars, their measurement, and the solutions adopted to minimize passenger discomfort from noise. The application of various types of sound insulating materials is shown. The results of acoustic measurements at different vehicle speeds are presented for several types of coaches put into service in recent years.

Silver, M.L.
NOISE AND VIBRATION CONTROL IN NEW RAPID TRANSIT
ASCE Transp Eng J v 98 n TE4, Nov 1972 pap n 9382, p 891-908

In evaluating the dynamic characteristics of transit systems, noise and vibration levels measured during the operation of more traditional transportation modes are summarized. Recommended design critiera established for operating systems are presented. Design strategies that may be used to limit the development of noise and vibration in transit system components are analyzed, 20 refs.

Tatraux-Paro, J.M.; Chezeaux, J.C.; Bismuth, W.
DOMAINE D'EXISTENCE OF BRUITS DE FROTTEMENT ET VERIFICATIONS EXPERIMENTALES (EXISTENCE OF FRICTIONAL NOISE REGION AND ITS EXPERIMENTAL VERIFICATION)
Acustica v 28 n 5, May 1973, p 272-278

The existence range, the frequencies and the amplitudes of rubbing vibrations are studied in terms of the slip velocity. The experimental results of three types of tires slipping on an iron track are studied in the first part of this paper. In the second part, the existence range and the frequency and amplitude of the oscillations of the stoker model slipping against different types of rubbing track are studied in terms of the slip velocity. Experimental and theoretical results show that the stoker model accounts for the process generating the rubbing vibrations for the low slip velocities, 11 refs, in French with English abstract.

Vorrhies, K.O.; Walsh, R.; Parsonson, P.S.
NOISE IMPACT OF ATLANTA'S FUTURE RAPID TRANSIT
Amer Soc Civil Engr meeting prepr 1763 (1972)

The possible effects of a rapid transit system on the noise environment of Atlanta, Georgia, were examined. Because traffic volume can be correlated with traffic noise, a traffic noise simulation model was employed and checked against measured noise readings. The simulation model was then used to predict noise levels for traffic volumes in Atlanta 20 yr in the future. These estimates were divided into 2 sets, 1 with a rapid transit system and 1 without. The lowering of noise levels from loss of traffic due to the transit system would be small. The gains made by reductions in automobile traffic would be insignificant and balanced by the increase in heavy vehicle traffic.

Ward, E.J.
NOISE IN GROUND TRANSPORTATION SYSTEMS
High Speed Ground Transp J v 7 n 8, Fall 1973, p 297-305

Passage of the Noise Control Act of 1972 has given added impetus to the drive for noise reduction. Section 17 of the act empowers the Environmental Protection Agency to issue railroad noise standards which will be enforced by the Federal Railroad Administration (FRA). FRA's High Speed Ground Transportation R&D programs has a goal of substantially increasing the speed of ground passenger travel. Without improvements in the state-of-the-art of noise suppression and noise avoidance higher speeds will inevitably mean higher noise levels. Therefore, the new systems developments are forced to include good acoustic designs by specifications of maximum permissible noise levels. Data on the wayside noise levels of various rail, transit and tracked air cushion vehicle systems are tabulated, and for comparison the noise specification used for developing the DOT ground vehicles is shown. Noise sources for guided ground transportation are discussed with respect to steel wheels, railroad yards, tunnels, elevated guideways, aerodynamics, propulsion, tracked air-cushion vehicles, tracked magnetically levitated vehicles, and tube vehicles. It is indicated where research and development can contribute to noise abatement. 8 refs.

Watkins, L.H.
URBAN TRANSPORT AND ENVIRONMENTAL POLLUTION
Transp Road Res Lab (GB), Trrl Rep Lr 455, 1972

The major adverse environmental effects of conurbation roads and road-traffic identified include noise; air pollution; visual intrusion; physical interference; and severance. Techniques are described for countering these adverse effects, and wherever possible criteria are given. The paper discusses control by planning and legislation, and gives an indication of the environmental consequences of two possible transportation systems of the future, 13 refs.

Wesler, J.E.
SURFACE TRANSPORTATION NOISE AND ITS CONTROL
J Air Pollut Control Assoc v 23 n 8, Aug 1973, p 701-703

Research and development programs are demonstrating that means to satisfy noise control regulations are technically practical and economically reasonable. The paper provides a review of federal regulatory areas and corresponding R&D activities pertinent to surface transportation noise abatement, 8 refs.

Traffic Noise

Design and Planning

Ljunggren, S.
DESIGN GUIDE FOR ROAD TRAFFIC NOISE
Natl Sweden Build Res Doc D10, 1973

Document describes a method for calculation of road traffic noise that is based on the equivalent steady level as the measure of disturbance. A relation is derived between the equivalent steady level, the distance from the road and the intensity and speed of the traffic. The model is applied for determination of the equivalent distance, which is defined as the distance where an imaginary and infinitely narrow road must be situated in order to produce the same equivalent steady level as the road under consideration, 33 refs.

Baier, H.
VERKEHRSPROGNOSE UND VERKEHRSLAERMPROGNOSE FUER EINEN NEUEN STADTTEIL (TRAFFIC FORECAST AND TRAFFIC NOISE FORECAST FOR A NEW TOWN SECTION)
Strassenverkehrstech v 17 n 4, July-Aug 1973, p 122-127

Forecasts of the motor vehicle traffic and of the noise caused by it have been made for a new section of the city of Darmstadt-Kranichstein in West Germany. Comparisons between noise levels of the local roads and of an express highway planned for construction in the vicinity are made possible. Although a number of questions remain open the investigation gave an interesting insight into the disturbance effect of local and trunk roads and into the efficiency of protective measures. The noise of non-shielded highways reaches values which appear intolerable from the viewpoint of new city planning. It can be lessened by placing the road in a cutting, by the erection of protective walls or earth embankments, to the noise level of the main roads in thickly populated areas. Special problems arise when tower blocks are built near highways. Noise protection standards urgently require revision, 18 refs, in German.

Control

Shahan, J.E.; Kamperman, G.W.
EFFECTS AND CONTROL OF HIGHWAY TRAFFIC NOISE
ASCE Transp Eng J v 99 n TE2, May 1973, pap 9726, p 307-322

Noise from highway traffic which has continually changing characteristics is described in statistical terms. Three qualities of time-varying noise required for a subjective evaluation of noise, magnitude, temporal characteristics, and frequency content are taken into account. The paper offers an introduction to highway traffic noise and to the effects of design and vehicle operational parameters on the noise.

Shahan, J.E.; Kamperman, G.W.
EFFECTS AND CONTROL OF HIGHWAY NOISE
Amer Soc Civil Engr meeting prepr 1731 (1972)

Basic concepts of highway traffic noise and its effects are discussed because of the time variation in traffic noise, a statistical description of the noise is required. Several traffic flow and highway design parameters and their effects on the statistical noise levels are evaluated; large trucks usually dominate highway traffic noise levels. Distance and barriers offer the greatest potential for reducing roadside noise levels. However, designers will face individual problems, where concern over schools, churches, parks, etc. will demand that more stringent requirements be applied. In these cases, it is necessary to apply research results of the effects of noise on humans to arrive at realistic design goals.

Ullrich, S.
GESCHWINDIGKEITSBESCHRAENKUNGEN - EIN MITTEL ZUR REDUZIFRUNG DES LAERMES VON AUTOBAHNEN UND SCHNELLSTRASSEN? (SPEED RESTRICTION - A MEANS OF NOISE REDUCTION CAUSED BY MOTORWAYS AND EXPRESSWAYS)
Strassenverkehrstech v 17 n 1, Jan-Feb 1973, p 9-13

The problem is considered to what extent is speed restriction a suitable and effective means for reducing traffic noise. In order to keep the number of the parameters considered as small as possible, it is assumed that the traffic flows freely along straight routes, as e.g. on the expressways and similar highways, or on other well constructed roads, outside built-up localities, and that the noise is freely propagated. The decrease of the energy equivalent of the lasting noise level with decreasing speed, the decrease of the mean peak level (mean energy value of the peak level) and the change of the "mean level oscillation" are calculated or estimated, in German.

Modeling

Delany, M.E.
A PRACTICAL SCHEME FOR PREDICTING NOISE LEVELS (L_{10}) ARISING FROM ROAD TRAFFIC
Teddington, Eng Natl Phys Lab, Acoust Rep AC 57, July 1972

A simple scheme is presented which allows values for noise levels (exceeded for only 10% of the time) out of 120 m from freely-flowing traffic on straight and level roads to be predicted without the need for calculation. Sets of contours are given which permit the evaluation of a wide range of configurations including elevated, level and sunken roads with noise barriers of various heights at different distances from the road. From comparisons made with recent field measurements covering a range of typical urban situations, it is estimated that the covering a range of typical urban situations, it is estimated that the absolute prediction accuracy is of the order 2 dBA while the relative accuracy is even better. This should prove entirely adequate for all normal planning purposes.

Delany, M.E.; Rennie, A.J., Collins, K.M.
SCALE MODEL INVESTIGATIONS OF TRAFFIC NOISE PROPAGATION
Teddington, Eng Natl Phys Lab, Acoust Rep AC 58, Sept 1972

A technique was developed for investigation of the propagation of noise from traffic on major roads and motorways using a 30:1 scale model. Validation studies were carried out for 10 different road/housing configurations by comparing model results with field data obtained specifically for the purpose. The modeling technique was capable of producing results substantially in accord with the field data. This model has been used to obtain systematic prediction data for roads in retained and in natural cut.

Lee, J.; Jason, C.Y.
ENERGY CHANGE NOISE: A MEASURE OF THE QUALITY OF FREEWAY TRAFFIC
Traffic Eng v 44 n 5, Feb 1974, p 28-35

A parameter, "energy-change noise", is proposed in this paper in an attempt to measure the quality of freeway traffic. It is defined as the standard deviation of the changes in kinetic energy of a vehicle as it travels through a section of roadway. The development of the parameter is based on the theoretical consideration that the magnitude and frequency of kinetic energy changes of a vehicle provides information on the quality of service provided by traffic, 5 refs.

Nelson, P.M.
COMPUTER MODEL FOR DETERMINING THE TEMPORAL DISTRIBUTION OF NOISE FROM ROAD TRAFFIC
Transp Road Res Lab (GB) Trrl Rep LR 611 1973

A new method is described for computing the temporal distribution of noise from freely flowing traffic, which is reported to be faster than Monte Carlo model of similar sophistication. Using the model, simple equations have been derived relating the computed values of noise to the traffic flow, mean speed, proportion of large trucks in the traffic stream and the distance from the roadway where the propagation is over grassland. The equations are designed primarily for traffic conditions beyond the range of applicability of existing prediction schemes, 17 refs.

Roeder, K.
EINE NEUE METHODE ZUR BERECHNUNG UND BEURTEILUNG DES VERKEHRSLAERMS UND DER ERFOHDERLICHEN SCHUTZMASSNAHMEN (NEW METHOD FOR COMPUTATION AND EVALUATION OF TRAFFIC NOISE ABATEMENT MEASURES)
St Autobahn v 24 n 6, June 1973, p 276-282

In German.

Harman, D.M.; Burgess, M.A.
TRAFFIC NOISE IN AN URBAN SITUATION
Appl Acoust v 6 n 4, Oct 1973, p 269-276

The results of a noise survey made within the Portsmouth city boundaries are outlined. Measurements were made throughout the 18-hour day at 33 sites which covered a wide range of traffic conditions. Comparisons were made between the published noise prediction methods and the measured results for sites adjacent to roads carrying free-flowing traffic. A modification is introduced to allow the design parameter employed by traffic engineers to be used in the prediction formula. The fall-off of noise levels with distance was also examined. An area classification is suggested for situations where the prediction formulas are not able to be applied, 7 refs.

Hillquist, R.K.; Bettis, R.A.
MEASUREMENT OF AUTOMOTIVE PASSBY NOISE
SAE Pap 720275 for meeting Jan 10-14 1972

Procedures for measurement of noise emitted by various automotive vehicles have been developed and refined by various technical committees of the SAE. Recent work on the parameters of these procedures indicates that the site used, the vehicle operator, and the ambient weather conditions are all significant factors in the accuracy of test results. Revision of these procedures to minimize the variation in results attributable to variation in test parameters, and to produce results more representative of typical operating modes of the vehicle, is essential.

Kurze, U.J.
STATISTICS OF ROAD TRAFFIC NOISE
J Sound Vibr v 18 n 2, Sept 22 1971, p 171-95

The investigations presented are devoted to the determination of the statistical parameters of traffic noise. In particular, the objective is to calculate the probability distribution, the mean and the variance of the sound pressure level. These data give the limits of meaningful predictions of the average sound pressure level from the simple model with fixed source locations and can be used to predict such parameters of importance for the human response to traffic noise as the noise pollution level, 18 refs.

Yerges, J.F., Bollinger, J.
MANUAL TRAFFIC NOISE SAMPLING - CAN IT BE DONE ACCURATEly
SV Sound Vibr v 7 n 12, Dec 1973, p 23-30

An evaluation of the manual sampling of traffic noise, carried out periodically using simple low-cost equipment, is made. The extent of errors made are compared with results recorded by elaborate instruments. A method is described that produces predictable estimates of noise levels of traffic, 7 refs.

Annoyance

Aoshima, N.; Kawakami, S.
ANALYSIS OF RESIDENTS' REACTIONS TO TRAFFIC NOISE
Proc Jap Soc Civil Eng n 219, Nov 1973, p 75-82

16 refs, in Japanese.

Highway Sound Barriers

Anon
HIGHWAY DEPARTMENT BUILDS EXPERIMENTAL SOUND BARRIER
Public Works v 108 n 11, Nov 1972, p 78-80

Experimental wooden and earthen sound barrier described is completed along a 1,916 ft section of Interstate 35W in South Minneapolis, Minn. The density requirements for the noise barrier walls meet the criteria required for structural strength. Post spacing and depth of embedment varies with the height of the walls. The wall design was developed to resist a design wind load of 30 pounds per square foot of wall area. A construction grade of lumber meeting stress requirements of F equals 1500 psi was used in the wall construction.

Gilbert, P.
UNE PREMIERE APPLICATION EN FRANCE D'UNE PROTECTION PHONIQUE UTILISANT LE PRINCIPF DE L'ECRAN (FIRST FRENCH APPLICATION OF AN ANTI-NOISE, ACOUSTIC SCREEN)
Travaux n 456, Mar 1973, p 11-20

Paper reports the results of an experimental installation of a concrete fence about 4 m high, provided with slot-like openings and baffles, separating one of very busy, 12-lanes highway and high-rise, apartment houses nearby, in French.

Harmelink, M.D.; Hajek, J.J.
PERFORMANCE TESTING OF FREEWAY NOISE BARRIERS
ASCE Transp Eng J v 99 n TE1, Feb 1973, pap n 9572, p 123-144

The results of the field evaluation along freeways in metropolitan Toronto show that the barriers are largely ineffective in reducing freeway traffic sound levels at nearby residences. Noise barrier types of an earth embankment, normal density, and lightweight precast concrete panel walls, an aluminum wall, a plywood wall, and a Gabion wall are described, including materials, appearance, type of support and costs, 6 refs.

Hauskins, J.B., Jr.
KINEMATIC SOUND SCREEN: UNIQUE SOLUTION TO HIGHWAY NOISE ABATEMENT
ASCE Transp Eng J v 100 n TE1, Feb 1974, pap 10353, p 169-178

Preliminary tests, conducted on a full-scale working model of a new noise barrier demonstrate the feasibility of the design, and show that it is capable of providing significant noise level reduction. The kinematic sound screen's noise attenuation properties compare favorably with other known sound barriers.

Reethof, G.
EFFECT OF PLANTINGS ON RADIATION OF HIGHWAY NOISE
J Air Pollut Control Assoc v 23 n 3, Mar 1973, p 185-189

The paper provides experimental verification by an analysis of the current literature. The types of noise sources in cars and trucks are treated as are community reactions to noise from such sources. The dBA is used as the accepted measure for characterizing truck and automobile noise. Both spherical and cylindrical radiation of sound are discussed for low density and high density traffic, respectively, 11 refs.

Reethof, G.
EFFECT OF PLANTINGS ON RADIATION OF HIGHWAY NOISE
Air Pollut Control Assoc J v 23 n 3, Mar 1973, p 185-189

The expected attentuation of automobile and particularly diesel tractor-trailer generated noise is treated in depth by the interposition of extensive and dense planting of trees and shrubs between the highway and the community. A belt of dense man-made growth of tall trees and underbrush can give as much as 5-8 dB truck or car noise reduction/100 ft of planting depth. Natural growth of deep forests were measured to give from 3 to 5 dB attentuation/100 ft of planting depth. Planting depth of at least 100 ft is required to give reliable results, with tree heights of 40-50 ft desirable and densities of 50-70 ft visibility needed for good effect. Experimental verification is provided by analysis of the current literature. The types of noise sources in cars and trucks are briefly treated as are community reactions to noise from such sources. The dBA is used as the accepted measure for characterizing truck and automobile noise. Both spherical and cylindrical radiation of sound are discussed for low density and high density traffic, respectively. An example is given of attenuation of a typical truck noise by spherical and cylindrical radiation for low- and high-density traffic and a 200 ft deep planting of dense, mature forest. A mature belt of either coniferous or decidous forest with underbrush can produce barely acceptable noise levels in the community which is separated by such a noise barrier from a heavily traveled highway.

Scholes, W.E.; Salvidge, A.C.; Sargent, J.W.
BARRIERS AND TRAFFIC NOISE PEAKS
Appl Acoust v 5 n 3, July 1972, p 205-222

This paper puts forward design rules for estimating the effects of long noise barriers on the propagation of motorway noise peaks. The rules take into account the effects of wind and ground absorption on barrier performance and thus cover a range of practical situations. This paper also suggests that, until the results of current research become available, these design rules may provide a useful indication of the effects of long barriers on the propagation of motorway noise in terms of L//1//0, 4 refs.

Highway Design and Planning

Anderson, G.S.; Gottemoeller, F.; Page, D.G.
BALTIMORE PLANS HIGHWAYS FOR MINIMUM NOISE
Civil Eng (NY) v 42 n 9, Sept 1972, p 74-78

The article explains how to predict noise levels of a proposed highway design, and in cases where that noise level exceeds goals, how to use earth berms and barriers to attenuate noise. Four case histories are presented.

Blitz, J.
PREDICTION OF L//1//0 ON URBAN MAIN ROADS
Acustica v 29 n 4, Oct 1973, p 210-218

A simple and non-statistical theoretical method for predicting L//1//0. The sound level in dBA exceeded for 10 percent of the time. Due to traffic in urban main roads,is given here. L//1//0 is determined as a function of the rates of flow of different types of vehicle for a given position of the observer (e.g. at curbside or at 10 m from the curb). It is assumed that the traffic speed is generally uniform : this is consistent with vehicle behavior on single carriageway urban roads subjected to a low speed limit (e.g. 48 km H**-**1). Variations of speed and the effects of "bunching" are taken into account. The predictions of L//1//0 compare well with experimental values obtained by Stephenson and Vulkan. It is also shown that, except where the density of heavy vehicles is low, L//1//0 is determined solely by the presence of heavy traffic, 7 refs.

Burt, M.E.
ASPECTS OF HIGHWAY DESIGN AND TRAFFIC MANAGEMENT
J Sound Vibr 15 n 1, Mar 8 1971, p 23-34

The design of the highway and the management of the traffic in noise problems are discussed. The conclusion is drawn that there are two alternative approaches to noise reduction. One is to reduce traffic flow and the other is to make use of noise barriers and environmental design. The relative importance of these two approaches depends on the types of road under consideration, 19 refs.

Collins, J.D.
CALIFORNIA TACKLES HIGHWAY NOISE
Civil Eng (NY) v 43 n 11, Nov 1973, p 56-59

Steps taken by the California Division of Highways for attacking noise problems in three areas are discussed and include reduction of noise from motor vehicles; adequate land-use zoning adjacent to highways by local governments; and proper highway design and location to protect the receptor from excessive noise.

Commins, D.E.; Kugler, B.A.
CHARACTERISTICS OF HIGHWAY NOISE PROPAGATION
Inst of Environ Sci Annu Tech Meeting 19th Proc Anaheim, Calif, Apr 2-5 1973 available from Inst of Environ Sci Mt Prospect, Illinois. 1973, p 298-300.

The specific problem of traffic noise propagation under free field conditions is considered. The physical units of noise used and the general methodology of traffic noise prediction are presented. This is followed by a description of an experiment designed to evaluate the characteristics of traffic noise propagation under a variety of traffic and environmental conditions. Partial results are also presented, 2 refs.

Curry, D.A.; Anderson, D.G.
PROCEDURES FOR ESTIMATING HIGHWAY USER COSTS, AIR POLLUTION, AND NOISE EFFECTS
Highway Res Bd Natl Coop Highway Res Program Rep n 133, 1972

The objective of the study were to evaluate various highway facilities under different levels of service and other conditions, and to develop a methodology that would relate these variables to user costs, travel time, air pollution, and noise effects. The methodology is presented in tables and graphs designed to minimize the amount of additional calculations, 51 refs.

De Cevallos, J.F.G.; Delgado, C.; Martinez, S.V.; Santiago, J.S.
PROJECT OF URBAN TRAFFIC NOISE CONTROL
Acustica v 29 n 4, Oct 1973, p 219-224

Physico-mathematical considerations about the shape of the probability distribution functions of the fundamental acoustical mangitudes intervening in a determination of urban traffic noise are presented. The shapes of the functions of the related magnitudes are determined by the assumptions made for one of them. It is deduced that, a priori it is not possible to postulate that an experimental distribution of sound pressure levels would fit to a normal law. Finally, the features that an automatic system for the acquisition and processing of acoustical signals must accomplish, are analyzed, 3 refs.

Dennington, D.
ASPECTS OF CONSTRUCTION, THE NEW URBAN ROADS
J Sound Vibr v 15 n 1, Mar 8 1971, p 35-9

Alternative measures to reduce the noise climate adjacent to roads are considered on the presumption that vehicle noise is not reduced at source. There is as yet no positive recommendation concerning the form a screen should taken within the limits of the road, but their effective use may be possible only along moderate stretches of road. If noise is to be abated it will cost the public money either in a direct or indirect form.

Gedney, D.S.
AIR AND NOISE CONSIDERATION IN THE HIGHWAY DESIGN AND CONSTRUCTION PROCESS
SAE Prepr n 730414 for meeting Apr 2-4 1973

Highway design and construction processes can and do have significant impact on a community and its environment. Geometric design innovations can significantly reduce air and noise pollution for a completed facility, but construction noise is especially difficult to control within tolerable limits unless engineers and equipment manufacturers seek better methods through investment in additional cost and improved technology.

Heer, J.E., Jr.; Hagerty, D.J.; Knadler, D.J.
EFFECT OF AN INTERSTATE HIGHWAY ON URBAN AREA NOISE LEVELS
Public Works v 105 n 1, Jan 1974, p 54-58

Results of a field study of the noise levels in a suburban area of eastern Louisville and Jefferson County, Kentucky, both prior to and after construction to I-64 through the area are discussed. Several National and International standards for acceptable noise levels for various types of areas are shown in which noise levels are listed in decibles as obtained on a sound pressure level meter, 8 refs.

Klossner, H.O.
BITUMINOUS OVERLAY REDUCES TRAFFIC NOISE
Public Works v 104 n 7, July 1973, p 82-83

A thin bituminous overlay was placed on a 1 one-half mile portion of crosstown highway in Minneapolis, Minn. in an effort to reduce noise. Noise loudness was reduced by about 1/3 as perceived by the average person and the ambient noise levels were brought within the range that is generally accepted as tolerable.

Kurze, U.
STATISTIK VON STRASSENVERKEHRSGERAEUSCHEN (STATISTICAL ANALYSIS OF HIGHWAY NOISE)
Fortschr Ber, Vdi Z Part 11 n 15, Oct 1973

For description of the highway traffic noise there are used, besides continuous sound level data, also various parameters that are based on the distribution of sound-level frequency. Paper presented a technique for numerical determination of these parameters for a freely flowing traffic and for propagation of sound. Vehicles of similar type and travelling at identical speed whose emission of sound can be approximated by a normal distribution of sound level are considered as elemental sources of highway traffic noise. Calculating technique is derived for determining the statistical parameters of square sonic pressures by means of which the influences of several, independent, elemental sources can be integrated. 80 refs, in German.

Piercy, J.F.; Embleton, T.F.W.
EFFECT OF GROUND ON NEAR-HORIZONTAL SOUND PROPAGATION
SAE Prepr n 740211 for meeting Feb 25-Mar 1 1974

The propagation of sound from a small source over the ground, considered as an impedance boundary, is discussed theoretically and compared with measurements over short grass and asphalt. Interference phenomena relevant to the measurement configurations in SAE standard procedures for testing vehicles are emphasized. The effect of the ground impedance on propagation at the longer distances relevant to airport and highway design is also discussed, 12 refs.

Slade, G.D.
MOTORWAY NOISE - A CASE STUDY
J Inst Munic Eng v 99 n 7, July 1972, p 195-203

The paper describes a noise study which dealt with that part of the M3 highway in Great Britain which passed within the Winchester City boundary. Existing noise levels were measured in the field and, using the field measurements as a base, future noise levels were estimated for 1989, having regard to increased traffic flows and speeds. Future noise levels were shown to be sufficiently high to adversely affect the environment and so attentuation measures, using earth banks and varying the motorway cross-section were suggested.

Ullrich, S.; Reinhold, G.; De Veer, H.
DAS VERKEHRSGERAEUSCH VON STRASSENOBERFLAECHEN MIT EINGESCHNITTENEN RILLEN (TRAFFIC NOISE CAUSED BY GROOVES CUT INTO ROAD SURFACES)
Strassenverkehrstech v 17 n 3, May-June 1973, p 82-85

The transverse grooves cut into road surfaces to improve gripping capacity in wet road conditions influence traffic noise. The increase of the noise level by these grooves and the changes in the composition of the frequency of the road traffic noise are determined experimentally. The results are presented in the form of graphs, in German.

Ullrich, S.
DER EINFLUSS VON FAHRZEUGGESCHWINDIGKEIT UND STRASSENBELAG AUF DEN ENERGIEAEQUIVALENTEN DAUERSCHALLPEGEL DES LAERMES VON STRASSEN (INFLUENCE OF VEHICLE SPEED AND PAVEMENT ON THE "EQUIVALENT CONTINUOUS SOUND LEVEL" OF STREET NOISE)
Acustica v 30 n 2, Feb 1974, p 90-94

Statistical measurements of the noise levels of passing cars and trucks have been carried out near various highways. The dependence of the noise levels at the pavement on the vehicle speed and on the dryness and wetness of the roads has been evaluated. The energy equivalent continuous sound level of the road traffic noise is calculated using the measured data, 9 refs, in German.

Waller, R.A.
MEASUREMENT AND CONTROL OF THE IMPACT OF NOISE FROM NEW ROADS
J Inst Highway Eng v 19 n 10, Oct 1972, p 9-17

The paper suggests several ways of measuring and predicting the impact of roads in context of noise annoyance and reviews ways of controlling noise nuisance, including soundproofing, land use, control of traffic, the setting-up of environmental areas and the use of compensation, 12 refs.

Webb, J.
NOISE STUDIES RELATED TO MOTORWAY ALIGNMENT
Highway Eng v 20 n 5, May 1973, p 6-16

The paper reviews some research work and published data concerning noise from highway traffic. Methods of calculating the noise environment expected to be created by new rural motorways are described, and acceptable noise exposure levels discussed. Examples of recorded noise levels are quoted for comparison and some field survey work is outlined, 20 refs.

Williams, T.E.H.
HIGHWAY ENGINEERING AND THE INFLUENCE OF GEOMETRIC DESIGN CHARACTERISTICS ON NOISE
J Sound Vibr v 15 n 1, Mar 8 1971, p 17-22

A general survey of the effects of road design features on noise is given in qualitative terms together with some quantitative data where available. The different problems of motorways and all purpose routes are compared. The results are discussed the observation made that noise from road traffic is predominant over all other sources. The need for further research into the effects of noise barriers is mentioned.

Young, M.F.; Woods, D.L.
SOURCES AND MEASUREMENT OF HIGHWAY NOISE
Tex Transp Res v 7 n 1, Jan 1971, p 6-9

The primary sources of noise are the tire-roadway interaction for automobiles and the engine-exhaust system for trucks and motorcycles: diesel trucks are the primary source of noise peaks and the major contributor to annoyance: the '%'A'%' weighted network (dBA) is probably the best means of physically measuring the noise level when it is desirable to evaluate the degree of annoyance associated with highway traffic noise.

Regulations and Standards

Close, W. H.
DEVELOPMENT OF INTERSTATE MOTOR CARRIER NOISE REGULATIONS
SAE Prepr n 740106 for Meeting Feb 25-Mar 1 1974

Decisions have been made regarding the Federal regulation of noise generated by motor carrier operations which are subject to the provisions of the Noise Control Act of 1972. This paper presents a brief discussion and analysis of the technical information developed by the interagency and task force and public docket, which was made available to the government for development of a regulatory strategy. Substantive research is under way to ascertain the technology and cost involved to significantly lower the engine-related and tire noise generated by trucks. 21 refs.

Leneman, G.
TRUCK NOISE - MEASUREMENTS AND CORRELATION TO INDUSTRY AND LAW ENFORCEMENT STANDARDS
Inst of Environ Sci, Annu Tech meeting, 19th Proc Annaheim, Calif, Apr 2-5 1973 available from Inst of Environ Sci, Mt Prospect, Illinois, p 320-326

The noise emitted during the operation of seven representative McDonnell Douglas Corporation (MDC) owned trucks was measured, under conditions specified by method SAE J-366. The data indicated that the maximum external noises of the turbo-supercharged diesel and gasoline trucks presently used on the open road by MDC comply with the current California vehicle noise standards for new vehicles (section 27160 of the vehicle code), and with the noise standards effective after January 1973 (86 dBA). For the truck operational conditions reported here, the internal (cab and sleeper) noises were well within the daily maximal industrial noise exposure criteria established by the Occupational Safety and Health Act.

Morrison, D.W.; Clarke, R.M.
REGULATION OF COMMERICAL MOTOR VEHICLE INTERIOR NOISE LEVELS
SAE Prepr n 720697 for meeting Aug 21-24 1972

This paper reports and analyzes two sets of test data that were taken to determine the interior noise levels of typical heavy-duty trucks. Under controlled test conditions, various stationary tests were run in an effort to correlate their results with those obtained during SAE J366 and J336 dynamic tests conducted at the same time. In addition, sound level exposures were determined for various over-the-road operations in an attempt to correlate these results with the static test results.

Paullin, R.L.; Safeer, H.S.
MOTOR VEHICLE NOISE GENERATION AND POTENTIAL ABATEMENT
SAE pap 720273 for meeting Jan 10-14 1972

The Dept. of Transporation has developed four computer simulation models designed to establish the noise levels that might be expected for different transportation modes as a function of the traffic characteristics peculiar to each mode. In addition, an understanding was developed of the technical, economic, and legal limits of potential abatement means for each transportation mode. The need for government standards and regulation was reviewed as was the need for additional research and development of successful means for reducing noise, 12 refs.

General Interest

Gibson, J.D.; Hart, F.D.
TRANSPORTATION NOISE AND SOCIETY
Inst Environ Sci Proc 17th Annu Tech Meeting, Living in our Environment, Los Angeles, Calif, Apr 26-30 1971, p 404-407

Systems design program had as its objectives; to provide a useful study of a broadly based societal problem that required the coordinated efforts of a multidisciplinary team; to provide communication between academic personnel and engineers and scientists; and to encourage interdisciplinary activity at the universities, 1 ref.

Jagtiani, H.
OBJECTIVE METHOD OF EVALUATING ASPIRATION WIND NOISE
SAE pap 720506 for meeting May 22-26 1972

Cars at high speeds are subjected to differentials in pressure between the car interior and the car exterior. The pressure differentials are sufficient to cause body seals in certain locations to permit air to pass by the seal, resulting in a noise defined as aspiration wind noise. An objective method of measuring aspiration wind noise at the leak source is introduced for cars at 70 mph and for static cars pressurized to simulate 70 mph. This method, using a meter, replaces the previously used method of subjective evaluation of the loudness of wind noise, an advantage of the new method is that it disregards the car exterior air turbulence noise component, which is a function of car stylng and aerodynamics.

Longrigg, P.
NOISE ABATEMENT AND VEHICULAR MOVEMENT WARNING DEVICES
IEEE, 24th Annu Southwest Conf & Exhib, SWIEECO Res Tech pap Dallas, Tex, Apr 19-21 1972, p 73-77

A system of vehicular movement warning devices is described, that should improve, to some extent, our present noise pollution problem. Two methods are detailed; one involves directional sonic devices, while the other utilizes ultrasonic techniques. A general discussion of the noise problem in developing urban areas, as it pertains to rail transportation, is given as a preamble to the abatement concept, 15 refs.

Lyon, R.H.
LECTURES IN TRANSPORTATION NOISE
Harvard, Mass, Grozier Publishing, 1973

The sources, paths, and receivers of noise are discussed after consideration of basic acoustic theory, descriptions of sound fields, sound sources, sound propagation, and engineering formulas. The generation, propagation, and effects of aircraft noise, automobile noise, motorcycle noise, truck noise, and rail vehicle noise are examined. These discussions also investigate the noise sources of V/STOL aircraft, absorption, refraction, and focusing of sound waves, annoyance, speech interference, psychoacoustic criteria, noise impact, the propagation of automative noise as affected by surface and topography, and ground vibrations.

Mazzini, G.
VENTILATION OF THE ROAD TUNNELS ON NAPLES URBAN MOTORWAY
Tunnels Tunnelling v 4 n 3 May-June 1972, p 201

Within the framework of the Tangenziale: a 12 mi long, high-speed motorway, being constructed in City of Naples, Italy, there are included several tunnels, totaling 2 ¼ mi, built beneath heavily populated sections of the city. Low-power, aerofoil axial booster fans with variable pitch, provided with silencers weighing 238 kg each, arranged in series have been selected for ventilation of 84 sq m cross-section area of the tunnels, to not exceed 3 mg/sq m concentration of fumes and 90 dB sound level.

Starr, E.A.
INSTRUMENTATION FOR NOISE POLLUTION
IEEE, Northeast Electronics Res & Eng Meeting, Nerem Rec, Tech Application pap, v 12, 1970, New York, p 14-15

Two of the measures that have been developed to quantify the effect of noise on human activities are discussed. Two examples of instruments are presented, one for speech interference, and one for airport monitoring.

Tempest, W.; Bryan, M.E.
LOW FREQUENCY SOUND MEASUREMENT IN VEHICLES
Appl Acoust v 5 n 2, Apr 1972, p 133-139

Sound pressure level measurements in cars traveling at motorway speeds have shown that much of the sound energy is in the low frequency and infrasonic regions. A technique has been developed to extend accurate octave band measurements down to the octave centered on 2 Hz. The system uses a calibrated sound level meter feeding a frequency modulation tape-recorder to record noise below 64 Hz, and an octave band analysis system to analyze the resultant tape recordings. Typical results are presented for a number of vehicles, 7 refs.

Waters, P.E.
CONTROL OF ROAD NOISE BY VEHICLE OPERATION
J Sound Vibr v 13 n 4, Dec 1970, p 445-53

Results of investigation of noise emitted by road vehicles with varying parameters of engine speed, road speed, gear ratio, acceleration and pay load are given: results from a 9 ½ truck and a 1500 cu cm car are presented and it is shown that noise at constant speed increases at a mean rate of 12 dBA per doubling of speed: when the vehicle is accelerating, this rate of increase is much reduced, although the maximum levels are similar to those obtained when the vehicle is running at constant speed; it is concluded that limiting speed and smoothing traffic flow reduces noise level:

Wilken, I. D.; Hickling, R.; Winich, H. V.
SINGLE-WHEEL TRAILER FOR TIRE NOISE RESEARCH
SAE Prepr n 740109 for Meeting Feb 25-Mar 1 1974

A single-wheel trailer has been designed and bult to study to origins of tire noise and its basic characteristics. The single test tire, nominally the 10. 00/20 size usually mounted on large trucks and semi-trailers, is located 12.2 m (40 ft) behind the rear axle of the towing vehicle to isolate it from other noise sources. Reflective surfaces that could interfere with noise measurements are minimized by the high, single-beam construction of the trailer. The towing vehicles if modified to reduce its noise and wake in the vicinity of the test tire, which can be loaded to 22.2 kn (5000 lb) by dead weights and rolled at expressway speeds, because of its unusual configuration, the dynamic behavior of the trailer was studied prior to design to help determine several design parameters and show that the trailer would follow well. Extension stress analyses of the trailer beam and other structural elements were also required. 16 refs.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1975— 210-810:70